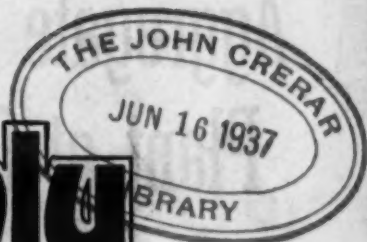


Contractors and Engineers Monthly



Vol. 34, No. 6

JUNE, 1937

\$1 a Year, 20 Cents a Copy

PICKS and SHOVELS

By O. E. POTTER

Safety and Intelligence

A construction organization in Southern California insists that every saw table shall carry a bronze plate embodying the safety instructions for proper saw operation. On one job of this company, a saw operator was instructed to mortise this plate into the side of the saw table, which he did. But in a great hurry to start the saw ten minutes after the job was completed, he entirely disregarded the instructions on the plate he had just fastened to the table and lost two fingers as a consequence.

All the safety instructions in the world are useless if they are not understood. It is up to the men in charge of the job first to see that the safety instructions are in evidence and second, to see that the why and wherefore of these instructions are sufficiently understood by the men that they may follow them with intelligence.

The Road to Hell Ended

The road to Hell, they say, is paved with good intentions but there is another road, known as Hell's Highway, which has been paved with human lives. That is the road, known officially as Route Zero, started some 50 years ago by the convicts in the penal colony in French Guiana and planned to extend 155 miles through the jungle. Only about 15 miles have been completed and 24,000 convicts have died during the work, about one human life for every yard of highway completed.

The recent decision to dispense with Devil's Island as a penal colony ends the work on Hell's Highway and, ardent as we are in the promotion of road building, we rejoice that the grim task of building a road to nowhere, through disease-infested jungle, has ceased.

"Skin-Mat" Used On Wis. Roads

Trunk Roads Carrying Heavy Traffic Maintained with New Surfacing Until Higher Type Pavement Can Be Built

(Photo on page 56)

THE problems of new right-of-way for relocating highways which are carrying heavier traffic each year and need better alignment, and the problems of financing these new roads are matters for the construction divisions of state highway departments to solve. In the meantime, the maintenance departments are carrying on in a valiant endeavor to make the old pavement do its work with a minimum expenditure until it can be replaced.

Wisconsin has done considerable work in bringing a longer life to its trunk highways which still must wait a few years for new and higher-type pavements, by applying a "skin-mat" to the gravel surface, using the material in the road, supplemented by such additional material from the ditches as may be needed, mixed with a slow-curing asphaltic oil on the road. This work is done by the maintenance forces in the various districts and has provided road surfaces which ride well and have a maintenance cost that is favorable.

Work in LaCrosse District

As an example of this type of work we are taking a section on U. S. 53 north of LaCrosse, Wis., done under the direction of the District Highway Office in LaCrosse. Some sections of this highway have been paved with concrete in recent years, and some in the current year, but not all of the right-of-way problems could be solved nor the finances secured to pave the entire highway leading to the northern lake district. These remaining sections have been treated with 0.4-gallon per square yard annually for three years to lay the dust and bind

(Continued on page 22)

Onion Tears Cease With Flood Control Project in New York

(Photos on page 56)



C. & E. M. Photo
Mounting Mats on Soft Sliding Ground Was a Ticklish Job

WHEN Goshen, N.Y. is mentioned in the presence of horsemen, thoughts of the Hambletonian Stake, the goal of every driver of a trotting horse, come to the fore. To the commission merchant in the provision field, Goshen brings to mind the most fertile onion country in eastern United States, acres upon acres of rich black dirt in which a King's ransom in tearful, lowly onions is grown annually. But floods sweep down the Wallkill River quite regularly and destroy many acres of onions which have just started on their profitable careers.

Sick and tired of this annual deduction from profits, sometimes amounting to all the profits, the Wallkill River Drainage Commission was formed lo-

U.S. Engineer Department Supervised Channel Change Project at Goshen, Using Rented Equipment

cally to consider ways and means to overcome the floods. The river rises in New Jersey and flows in a generally northerly direction until it reaches Roundout Creek at Kingston, N.Y. In the vicinity of Goshen the stream flows from northwest to southeast but turns north near the town to keep its rendezvous with the stream that carries its waters to the Hudson River.

To consider a channel change in the midst of fertile lands that bring as much as \$600 to \$1,000 an acre required resolution and determination, but the Commission, with the assistance of the U. S. Engineer Department, mapped out a program that called for the purchase of \$300,000 of new right-of-way for a 4½-mile channel change and the clearing of the remaining 5½ miles of the stream by widening and deepening and then lining the entire 10 miles with a satisfactory riprap.

Since much of the work did not require skilled labor, the Federal Government decided that this might well be a CCC project. The U. S. Engineers established an office in New Hampton, N.Y., in 1935 and eighteen camps of CCC workers sprang up in the vicinity to house a total of 2,200 white and 1,400 colored CCC boys. A field staff of 100 experienced civilians was organized to handle the work.

Eight Speeder cranes for use as draglines and shovels, a fleet of Koehring Dumpsters, Caterpillar Fifty tractors and Indiana trucks were purchased new by the government. Some lighting plants, two Caterpillar RD-8 tractors and a fleet of GMC trucks came from Passamaquoddy. The remainder of the light trucks came from other government projects. The area became the largest graveyard of broken-down light trucks in the country. But a well-organized repair shop, also the largest in the country, was built and soon a fleet of nearly 200 trucks was ready to haul anything anywhere.

New Roads Precede Excavation

The first job was to build some 15 miles of roads to connect the various camps and the actual construction activities. Then it was time to start the excavation of the 1,500,000 cubic yards of dirt for the new channel, and the 500,000 yards of excavation for channel widening and deepening. The 4½-mile cut-off channel was excavated to a bottom width of 70 feet, a top width of 140 feet and an average depth of 18

(Continued on page 16)

DOUBLE DUTY WITH ELEVATING GRADER



C. & E. M. Photo

A Channel Change Provided a Borrow Pit for Covering Rock Fill Nearby on the Skousen Bros. Contract Near Gallup, N. M. See Page 5.

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Aggregate and Concrete Plant at O'Shaughnessy Dam

Interconnecting Conveyor System and Aerial Tramway Feature Work on Addition to Present Structure

By JOHN H. RYAN,
Construction Engineer, Hetch Hetchy
Water Supply

(Photo on page 56)

O'SHAUGHNESSY DAM, the structure forming the main storage for San Francisco's water supply, is located in Tuolumne County, California, within the boundary of Yosemite National Park. The dam, built in 1919-1923, is of the arch gravity type, 226 feet above the stream bed and 344 feet above the lowest point in the foundation. The crest length is 605 feet, the maximum thickness at the base 308 feet, and the arch radius 700 feet measured close to the upstream face. The present structure is built of cyclopean concrete, the total yardage being 398,000. The entire foundation is Sierra Nevada granite of finest quality.

The original design anticipated the present addition and therefore many features were taken care of during the first construction. The base of the existing dam was built to the full size of the future dam at stream bed, and the downstream face finished in steps, in order to facilitate bonding the addition to the existing structure. All water stops were left so that they could be continued beyond the height of the original dam and provision was made for extending the inspection galleries into the new structure. The eighteen existing siphon spillways are to be plugged with concrete and a new overflow weir spillway with drum gate control constructed at the south end of the dam.

The enlargement consists of building an addition 80 feet thick at stream level against the downstream face of the present dam to increase the thickness and continuing this addition 85.5 feet above the present crest elevation. The enlarged dam, with a total height of 430 feet, will be the second highest dam in the world. It is estimated that 280,000 cubic yards of concrete will be required.

Specifications

Four size ranges of coarse aggregate are required. The grading of size ranges

by weight is specified as follows:

	6-Inch to 3-Inch Range	Percent
Passing a sieve with 6-in. square openings.....	100	
Passing a sieve with 3-in. square openings.....	55-75	
Passing a sieve with 4-in. square openings.....	20-40	
Passing a sieve with 3-in. square openings.....	0-5	
	3-Inch to 1½-Inch Range	
Passing a sieve with 3-in. square openings.....	100	
Passing a sieve with 2½-in. square openings.....	55-75	
Passing a sieve with 2-in. square openings.....	20-40	
Passing a sieve with 1½-in. square openings.....	0-5	
	1½-Inch to ¾-Inch Range	
Passing a sieve with 1½-in. square openings.....	100	
Passing a sieve with 1-in. square openings.....	35-65	
Passing a sieve with ¾-in. square openings.....	0-5	
	¾-Inch to ½-Inch Range	
Passing a sieve with ¾-in. square openings.....	100	
Passing a sieve with ½-in. square openings.....	35-65	
Passing a sieve with ¼-in. square openings.....	0-5	

Four classes of concrete are used. Their properties, and the proportions of materials utilized, are as follows:

	Class	A	B	C	D
1. Water, total, maximum gal. per sack cement.....	7.50	6.75	6.75	6.75	6.75
2. Cement, minimum no. of sacks to 1 cu. yd. of concrete in place.....	4.75	5.33	6.		
3. Coarse aggregate, maximum size, inches.....	6	3	1.5	.75	
4. Slump, maximum, in inches.....	3	2.5	4.5	4.5	

Preparation of Aggregates

To produce the various sizes of aggregates, the contractor, the Transbay Construction Co., has built a unique plant.

Sand is obtained from a deposit in Miguel Meadow, 3 miles by air line from the concrete plant. It is transported by

an aerial tramway with endless line carrying 42 buckets, each of 32-cubic foot capacity, which deliver the sand at the rate of 48 cubic yards an hour. The cables are carried on seventeen timber towers, the spacing of which varies with the topography. The longest span, that crossing the Tuolumne River canyon, is 2,727 feet. The elevations are: loading terminal, 5,040 feet; highest summit, 5,568 feet; discharge terminal, 4,085 feet. The entire operation is by gravity, the loaded buckets pulling the empty buckets back to the loading terminal. To regulate the rate of discharge, the speed is retarded by a large air fan at the loading terminal.

At the pit a Lima diesel-powered shovel with dragline attachment loads the sand into trucks which deliver it to bins at the tramway loading terminal.

Rock for the concrete is obtained from a granite quarry located almost one mile from the mixing plant. The face of the quarry is 350 feet wide by 250 feet high. The quarried material is loaded by power shovel into 10-yard trucks which transport it to the primary crushing plant, a 48 x 60-inch Allis-Chalmers jaw crusher, driven by a 250-hp motor, with a capacity of 200 tons an hour. The discharge take-off is a 36-inch belt conveyor, which carries the crushed material, up to 6-inch in size, to a 20,000-cubic yard stockpile. The material is then drawn from the storage to a loading platform by a 36-inch belt conveyor located in a tunnel under the pile.

At this platform the material is at present loaded on to a high-line con-

(Continued on page 11)



C. & E. M. Photo
The Blackwell Jetting Machine Which Has Been Used Successfully on Missouri Contracts

Jetting Fills In Missouri

Method of Compacting Earth Fills Now Standardized, New Equipment Developed

SHEEPSFOOT rollers, with and without added moisture, careful laying of earth in 6-inch layers, and other methods are used in various states for the compaction of earth fills to insure the maximum density of the completed fill. Missouri depends on the spreading of the earth in 12-inch layers. To complete the process of making the embankment as solid as possible jetting is used. Two methods are employed, of which one requires a special piece of equipment developed for this work and the other the usual jetting pipes and water line along the shoulder.

The jetting holes are 5 feet on centers and are either holes bored with a 6-inch auger or by pressure jetting with a pipe of suitable diameter and length and constricted at the end to give greater force to the water to jet the hole through the compacted layers of earth more readily. Some contractors use a post-hole auger mounted on the front of an International Harvester tractor for boring the holes.

The holes, whether made by boring, hand jetting or machine jetting, are carried to within 1 foot of natural ground surface. They are carried to the edge of the pavement section and in other cases to within 6 or 7 feet of the outside shoulder line. The reason for not carrying the jetting closer to the outside of the fill is that there is some danger of the fill being soaked too much on the outside, causing a slipping, or of the water escaping from the fill and not sufficiently soaking the volume of earth in the center of the fill.

After the holes are completed the area is ponded for 56 hours with water which is held in place by dikes. These dikes are thrown up by running a power grader or drawn grader along the fill and throwing up the required side dike and then either using the same outfit to make the cross dikes or running a bulldozer along, making the ridges in the earth in that manner. The spacing of the dikes is entirely at the discretion of the contractor but usually they are 12 to 15 feet apart on the level sections. Where there is a grade the cross dikes must be closer together to prevent water running over the top.

After the 56 hours of ponding, the inspector for the state highway department makes frequent hand-auger holes to determine whether the fill is completely saturated.

New Jetting Machine

Pressure jetting is done in two ways, first by the use of ordinary jetting pipes put down by hand and second by a new

(Continued on page 27)

Hot Weather Troubles on Illinois Paving Job

Concrete Set Too Fast and Damp Grade Dried During Hot Weather on Hurden Constr. Co. Job

(Photos on page 56)

ILLINOIS specifications require that the subgrade shall be in a moist condition at the time concrete is placed. If necessary, it shall be saturated with water not less than six hours nor more than twenty hours in advance of placing the concrete slab. This prevents absorption of the mixing water by the subgrade and insures the best results from the designed mix. In the old days, it was sufficient to wet the grade immediately ahead of the paver but in some soils, this makes the grade sticky and causes a great deal of mud to be picked up and mixed with the concrete, to its detriment.

The terrific heat of last summer dried up every drop of water placed on the

grade six hours before the concrete was placed. On the Hurden Construction Co. job from Roanoke to Benson, Ill., last July, it became necessary to sprinkle the grade again lightly just before the concrete was placed to insure some degree of moisture in the subgrade.

Rough Grading

There was approximately 78,000 cubic yards of excavation on this job which was handled with an Austin-Western elevating grader and five Euclid 8 to 12-yard crawler wagons. The dirt was leveled down on the fills with a Baker bulldozer mounted on a Caterpillar Fifty tractor.

The fills were laid in 6-inch lifts, loose measurement, disked and rolled with a Euclid sheepsfoot roller. Each lift, if deficient in moisture, was sprinkled with water until the moisture was sufficient to produce maximum compaction, according to the new Illinois specifications put into effect for the first time in 1936. The surface of the finished grade was smoothed with an Adams 12-foot blade pulled by a Caterpillar Sixty.

Preparing the Grade

On a grade that ran a little high the contractor used a Caterpillar gas Fifty and a Lakewood scarifier to loosen the hard spots and then took out as much material as possible with the same tractor and a 5-foot rotary scraper. Following as closely as possible behind the grading, the Ted Carr Formgrader cut the trench for the 8-inch base of the 9-inch Blaw-Knox forms. The final preparation of the form trench was entrusted to three men who kept just ahead of the boss formsetter and his helper. After the forms were set and it was possible to gage the grade more closely, a Caterpillar Thirty and another 5-foot rotary scraper took out more of the high spots. Trimming of the grade and windrowing the material so that it could

(Continued on page 24)



Part of the Aggregate-Handling Conveyor System at O'Shaughnessy Dam. The 135-Foot Conveyor from the Sand Washing Unit to the Stockpile Is Seen at the Left, and at the Right the 255-Foot Main Belt from the Secondary Crushers to the Shaker Screens.

"Public Square" PAVEMENTS



A TEXACO Asphalt pavement serves the concentrated traffic around the Public Square of Jacksonville, Ill.

DEMAND EXTRA CARE IN CHOICE OF MATERIALS

The Public Square, centre of a community's activity, is the converging point of traffic. Cars, trucks, buses fill the Square from dawn to dark, day in and day out.

Pavement construction around the Public Square, more than anywhere else in the city, demands extreme care in choice of materials.

With this in mind, consider the many instances where contractors paving America's Public Squares have selected TEXACO Asphalt for the job.

These TEXACO-paved Squares testify that, under the stiff traffic test such pavements must meet, the contractors were confident TEXACO Asphalt was "their best bet."



ASPHALT

THE TEXAS COMPANY, Asphalt Sales Department, 135 East 42nd Street, New York City
Chicago Cleveland Kansas City Houston Dallas Buffalo Philadelphia Richmond Boston Jacksonville

Contractors and Engineers Monthly

THE NATIONAL BUSINESS PAPER OF THE CONSTRUCTION INDUSTRY

Issued Monthly by Bittenheim-Dix Publishing Corp.

Publication Office: Mount Morris, Ill.

Editorial and Business Office: 470 Fourth Ave., New York City

TOM DIX, President
EDGAR J. BITTENHEIM, General Manager
MYRON MACLEOD, Advertising Manager

THEODORE REED KENDALL, Editor
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Creating Roads for 24-Hour Safety

That the roads of today have not been built for 24-hour safety is all too strikingly shown by accident statistics. There is a definite need for a more careful evaluation of the various factors which can contribute to the safety of the highway in order that our road funds may be expended in the proper ratio for the construction or installation of the components of safe highways.

We believe that State Highway Departments, Federal highway engineers and all concerned with the construction of our highways should place before them an ideal of 24-hour safety when designing any highway. Thousands of bad curves on highways have been removed in the past few years by relocation, and the vast program of grade-crossing elimination has wiped out many of those hazardous double right-angle turns across railroad tracks at grade and through old narrow underpasses. The separation of traffic moving in opposite directions by means of raised medial strips is another great contribution to 24-hour safety.

Illuminating engineers advocate high-intensity night lighting of highways and have made some excellent installations on heavy-traffic arteries to demonstrate its value. R. E. Simpson, speaking at a joint meeting of the Illuminating Engineering Society and the National Safety Council last January, pointed out that among the more recent investigations of the reduction in the night-accident rates through improved fixed highway lighting is that of the parkways in Westchester County, N. Y., covering a period of four years, and also two parkways on Long Island, N. Y., for a three-year period, the total involving a traffic exposure of over one billion vehicle-miles. These parkways are, in effect, heavily-traveled restricted highways, the restrictions all tending to reduce traffic hazards. In Westchester County, with lights in full service, the ratio between day and night-accident

rates was 1 to 2.2; with the lighting reduced 40 per cent, the ratio was 1 to 3.7; and with all lighting turned off, 1 to 4.8. On Long Island, the day to night-accident ratio was 1 to 1.4 with lights on, and 1 to 2.6 with lights off. This is conclusive evidence that there is real safety value in highway lighting.

But there is the question of financing safety. Many states are trying to prevent further diversion of highway funds for such things as the propagation of shellfish, education and other uses not directly connected with highway construction and maintenance. Automobile owners are bearing the entire burden of highway construction and maintenance in most states through gasoline taxes and vehicle taxes and licenses. Even were all of the funds from these sources made available for roads, we could scarcely keep up with the need and demand for more and better highways. Just where the funds will come from for the first cost and the high maintenance cost of present-day highway lighting systems is a matter of conjecture. We can capitalize the value of human life, property damage and loss of time and figure prodigious sums that might be saved by highway lighting, but unfortunately these sums are purely of the mind rather than cold cash.

We must make the money invested in new highways pay higher dividends in safety. The expenditures for the construction of highways that will be safer 24 hours a day must be weighed with the additional money for highway lighting which pays dividends in increased night safety but contributes nothing to daytime safety. Existing high-accident areas should be protected by highway lighting but we must not let our enthusiasm for this new safety measure dull our perception of the limits of economic justification of highway lighting when there is such a tremendous demand for immediate construction of roads which will give 24-hour safety.

Public Judges Road By Quality of Surface

This is true whether the surface be concrete, asphalt, gravel, stone or cinders. In order to keep a road surface smooth, it is necessary to give it constant attention. In the cases of concrete and asphalt pavements, it is necessary to keep the joints and cracks which have developed sealed with bituminous material. The depressions or settlements which occur must be raised or patched. In cases where definite breakage occurs, or cuts are made, it is necessary to place new concrete or bituminous material.

Gravel surfaces require almost constant attention. In Wayne County, Mich., multiple blade maintainers and scrapers drawn by tractors are kept busy smoothing the surface. In summer when traffic is heaviest, this equipment is operated from daylight to dark. The most objectionable feature of a gravel road is

the dust. As far as available funds permit, the dust nuisance has been reduced to a minimum, according to the Thirtieth Annual Report of the Board of Wayne County Road Commissioners. Periodical treatments with calcium chloride are given the surfaces in front of residences, and where the homes are fairly close together, the entire road is so treated. New gravel is added to surfaces from time to time where needed, to replace that which has been worn off by traffic.

The economic revival in Togo, a former German colony now mandated to France, and which is essentially an agricultural region, owes much of its present prosperity to the extension of its highway system, which has made possible the automobile transportation which has been a basic factor in the colony's economic and commercial activity, according to a report from the U. S. Bureau of Foreign and Domestic Commerce.

Proper Curing in Ind. Eliminates Scaling

To the Editor

CONTRACTORS AND ENGINEERS MONTHLY:

I have read with interest the article entitled "Surface Scaling of Concrete Roads" which appeared in the May issue of CONTRACTORS AND ENGINEERS MONTHLY.

The difficulties encountered with scaling in many states have been noticeably absent in Indiana. We attribute our good fortune in this regard to our use of wet straw for curing on our rural concrete pavements. Both water and straw are normally cheap and plentiful here; hence there is little incentive for other than a liberal use of both.

We have had some trouble with hair checks at times. These have been known to occur during the finishing operation and under wet burlap, before the straw was applied. The resulting cracks are unsightly, especially after they have been filled with bituminous material. However, I have never noticed any scaling that developed from these cracks and I have continued to observe one group of such cracks for which I was responsible thirteen years ago.

There has been much discussion among our engineers on the cause and cure of hair cracks. We have noticed that they generally occur during a long dry weather condition and during a period when there is a breeze blowing. Aggregates that have been stocked for a long time and permitted to drain and dry thoroughly are conducive to the development of hair cracks.

When one of our projects develops this ailment, we immediately proceed to apply burlap at the earliest possible time and keep it wet. We have also wet dry aggregate storages during the night so that absorption from the concrete was reduced. With these precautions, we have reduced and in some cases eliminated such conditions.

Improper use of chemicals for ice removal has developed scaling. We have had this experience with some new pavements in cities, during the first winter after construction. Apparently, the chemical reaction takes place more readily on new pavements than on old. Intelligent application of chemicals has served a useful purpose, but the misapplication can destroy a concrete surface.

Any engineering research that can develop control of scaling and hair cracks would be beneficial to the construction industry.

Yours very truly,

SULTAN G. COHEN,

Engineer of Construction,

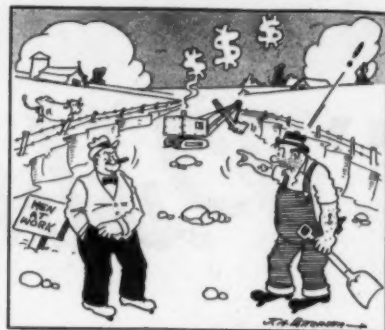
Indiana State Highway Commission, Indianapolis, Ind., May 25, 1937.

Deterioration of Concrete

Bulletin No. 5 of the Civil Engineering Research Laboratories of Columbia University series, entitled "The Deterioration of Concrete in Normal Service" was recently published. This report, by David L. Snader, former Research Fellow at Columbia and now Professor of Civil Engineering at Stevens Institute of Technology, contains an outline of the investigation and a discussion of the hydration and hydrolysis of portland cement.

The investigation was made possible by the Peters Fund and the cost of publication of the report was carried jointly by this fund and by a grant from Stevens Institute of Technology which cooperated with the Department of Civil Engineering at Columbia in making the results of the investigation available.

Copies of this report may be secured from the Research Laboratories, Department of Civil Engineering, Columbia University, New York City. Price \$1.00.



"Sure I Know What He Means. He Wants to Borrow Three Bucks 'Til Pay Day"

A Parable of Riches

Reputedly the richest man in the world, the Nizam of Hyderabad, who is said to possess \$150,000,000 in jewels and \$1,400,000,000 in capital, according to a recent issue of *Life* magazine, has modernized his 1910 Rolls-Royce by the addition of streamlined mud guards. Since the Nizam is also reputedly one of the stingiest men in the world, the picture of modernizing an antiquated motor vehicle with 1937 fenders is explainable.

Here in the United States, we have a much-to-be-deplored parallel in a great number of our roads, according to the American Road Builders' Association. Built for 1910 travel, they have been patched with 1937 road material to meet 1938 traffic demands. In many cases where this has occurred, the states have had plenty of money for the building and upkeep of good roads, but the money collected by them for this purpose has been diverted to other uses.

And so the death toll mounts, as the plea for the use of highway funds only for highway purposes goes unheeded in many states. "Modernize your roads" says Charles M. Upham, Engineer-Director of the American Road Builders' Association, "and build safety into your highways so that they can handle the ever-increasing demands of today's fast-moving traffic. The driver is not always at fault, as some safety movements would have you believe. There are literally thousands of curves on our state roads that must be straightened out; thousands of overpasses and underpasses that must be provided for heavily travelled intersections; thousands of danger areas that must be lighted and made safe for night travel; thousands of miles of non-skid surfacing that must be laid; thousands of miles of pedestrian walk-ways that must be built, if the expression 'safe highways' is to come to represent a truth."

"Let the Nizam have his antiquated chariot . . . but don't let us keep our antiquated highways. It is our purpose to save as many lives as we can . . . States can not afford to be stingy with the money provided by the highway taxes for good roads. The people of a state, their long life, must be served."

Plans for 1937 Road Work In New Brunswick, Canada

The Provincial Government of New Brunswick, Canada, has awarded contracts for the construction of 228 miles of paved highway in that province, the work to commence immediately and continue through the summer. The pavement will be of asphaltic concrete, a type similar to that already laid on the truck highways during the past three years. The U. S. Bureau of Foreign and Domestic Commerce reports that during 1936, the Province of New Brunswick awarded contracts amounting to \$5,500,000.

In addition to the contracts for highway construction, five bridges, of reinforced concrete, have been contracted for at a cost of \$57,500.

New Location Saves Five R.R. Crossings

Skousen Bros. Build Two Sections of New Grade, Drainage Structures and Base East of Gallup, N. M.

(Photos on page 56)

MAKING dirt and rock fly is a specialty of Skousen Bros. of Albuquerque, N. M. When they were awarded the contracts for the construction of the grading, drainage structures and 6-inch compacted base course for WPGH-27 and FAP-27 and 75 reopened, they wasted no time. The work was started May 15 and less than three weeks later the entire project from end to end looked as though a serious contractor had hit it hard. A full complement of equipment was used and the work divided into two sections, the westerly in charge of Dan D. Skousen and the easterly section with the heavier grading in charge of Nate J. Skousen. The third brother, J. E. Skousen, was in charge of another contract some distance away but before this work was completed he was handling a portion of the final clean-up.

Working the West End

Dan Skousen started his outfit about 1½ miles from the west end of the job and worked east. He had 26 head of mules with 5-foot fresnos, a Caterpillar RD-8 diesel tractor hauling a 12-yard Super Carryall scraper and a Caterpillar Seventy gas tractor pulling an 8-yard Carryall scraper, and five company-owned 5-yard Internationals with six 1½-yard hired Ford and Chevrolet trucks working under the Lorain 75-B and Lorain 55. A Caterpillar No. 11 Auto Patrol was used to finish off the fills and to keep the winding road over the right-of-way smoothed so that any piece of equipment in the entire outfit could make fast time over the construction road.

Stone for the concrete structures was produced on the job. The limestone quarry which was an outcrop of hard stone was drilled on 5-foot centers and then shot at one time, leaving the entire quarry a mass of relatively small rock which was fed to the hopper of the portable Pioneer crushing and screening plant by a Caterpillar Forty with a LeTourneau bulldozer. The 1½-foot over-burden was removed first with one of the Carryall scrapers. The material was sized on a double vibrating screen and the oversize crushed and returned to the screen. The screened material was delivered by two belts to a 5-yard bin for the coarse material and a 2½-yard hopper for fines. The base material was similarly prepared in a Cedar Rapids 9 x 36 crusher.

For the concrete structures of which there were many, Dan Skousen had a 2-bag Rex and a 1-bag Jaeger mixer. The job was completely equipped with CMC aluminum wheelbarrows with rubber-tired wheels and the contractor reported that the investment in this more expensive equipment was well warranted as the men handled just twice as much material in each load as with the old "paddy" barrows with iron trays.

The job was worked with two 5-hour shifts, the first from 7 to 12 and the second from 1 to 6. The contract allowed a 30-hour week, 8-hour day, and a 130-hour month for labor.

In two channel changes, there was 32,000 cubic yards of excavation. On one the entire excavation was handled with a Carryall scraper and on the other by a shovel loading to two trucks. The bridges for these channels were a 2-

span and a 3-span structure with 40-foot spans.

The East End

The east end involved more rock work and a larger channel change and some deep earth cuts. The working of these was of considerable interest. On the rock cuts the entire ledge was drilled to a maximum depth of 18 feet on 5-foot centers, using I-R detachable bits from 2 down to 1½-inch. The compressed air for the work was furnished by an I-R 2-stage Model 85 compressor mounted on a truck and another portable of the same size on steel wheels. The holes were loaded with Hercules 40 per cent extra dynamite and Herculite No. 4 40 per cent powder and fired with Herco tube electric blasting caps.



C. & E. M. Photo

Cutting 1:2 Slope with a Carryall Scraper

For moving the material, which was well broken by the shots, the contractor used a Carryall scraper. Where the rock was a well shattered shale and could be broken more easily it was torn up with a LeTourneau ripper pulled by a Caterpillar Seventy-Five diesel which had a

LeTourneau bulldozer mounted on the front of the tractor so that the tractor became a triple threat. The 12-yard Super Carryall was pulled by a Caterpillar RD-8 tractor.

Earth was moved rapidly in a com-

(Continued on page 46)

Proved in Service

A FEW OF THE MANY
NORTHWEST TRUCK
CRANES THAT HAVE
PROVED THE VALUE
OF NORTHWEST SUPERIOR
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Soil Mechanics Studies By Kansas Highway Dept.

The Kansas Highway Department has a small department for the study of soil mechanics. The department carries on its routine work of conducting soil surveys and assisting with construction work through six Division Materials Engineers who have been trained in soils work. Two field parties which operate out of the central laboratory are assigned to special problems and also assist the field men in making surveys when it is necessary. The Soils Engineer or Assistant Soils Engineer studies all locations with the field men before recommendations are made to the Design Department. Soils work is carried on in conjunction with the Engineer of Tests, under the direction of the Engineer of Materials. Soils work was begun in Kansas in 1931.

The work of the men in charge of soils studies begins as soon as the plans party commences work on a new location. They make borings, take samples, identify soils, draw up the soils profiles, make preliminary compaction tests, locate points of seepage, etc., and otherwise study conditions which will affect the future roadway.

The Resident Engineer follows through the work of the Soils Survey, reporting the results obtained with the different soils in fills and foundations. The field men, being familiar with conditions, are able to assist the Resident Engineers with problems which arise during construction.

No survey has been altogether accurate and complete as all conditions cannot be located and foreseen even by a detailed survey. The final responsibility rests on the Resident Engineers who have shown much interest and have been responsible for much of the progress which has been made in soils studies in Kansas.

Contractor Converts Ford Into Heavy-Duty Unit

In order to use its Ford truck for the heavy-duty service of hauling black top to the job, the Lang Construction Co., of Chicago, had the truck equipped with a Thornton Four Rear Wheel Drive and a dump body. This increased the capacity of the truck to accommodate 8 yards of the black-top material, amounting to something over 9 tons a load.

The accompanying photograph shows



Dumping Black-Top from a Thornton-Four-Rear-Wheel-Drive-Equipped Ford Truck Into an Adnurn Paver

the truck dumping a batch of the hot black-top into the hopper of an Adnurn paving machine which was used to spread and finish the material. Both vehicles are in motion and the truck driver is watching the speed to keep the truck in pace with the paver following him. The Thornton Drive low gear re-

duction of 87:1 permits a slow even speed during the dumping operation and the speed ratio of the Thornton transmission permits making good time on the trip back and forth between the mixing plant and the job.

The eight tires under the load permit the truck to go where a single drive axle

truck could not go without damaging the road. The chassis weight is only 6,500 pounds, whereas a conventional truck large and strong enough to carry the same payload would weigh about 9,000 pounds.

The Thornton Four Rear Wheel Drive is made by the Thornton Tandem Co., 5155 Braden St., Detroit, Mich.

County Roadside Clean-Up

The main job under this heading in Wayne County, Mich., is the mowing of grass and weeds. This is not only necessary to improve the appearance of the road but also as a measure of safety and as a preventive for the spread of obnoxious weeds. The cutting of grass and weeds also prevents or reduces the formation of snow drifts in the roadway.

Tractor mowers, supplemented by gangs with scythes, are kept busy from May to September on this type of work. Often the equipment is kept moving fourteen hours a day.



In the custom mill of the Cripple Creek Mining and Milling Co. of Cripple Creek, Colorado, this 48 in. Tel Smith Gyrasphere Crusher is in closed circuit with a vibrating screen, all ore being crushed to minus $\frac{3}{4}$ " before going to the roaster.

Crushing the Ore FROM 30 MINES.....

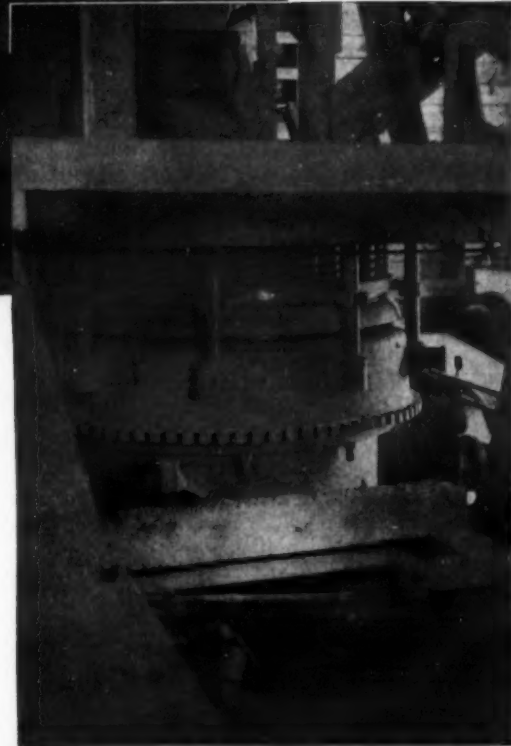
Like all other Tel Smith Crushers, this 48-in. Tel Smith Gyrasphere takes its rock as it finds it . . . hard, harder, or hardest . . . turns out a finer, more cubical product . . . and a lot more of it . . . in faster time . . . with less trouble, less power and less up-keep.

The Gyrasphere takes an unregulated and unlimited choke feed! Try to find another secondary crusher that can do it.

Like a mortar and pestle . . . only inverted for easy discharge . . . the spherical head and its corresponding concave catch and break the chunks of rock between two multi-curved surfaces—giving a perfect cubing action.

Double protectors . . . four flexible leather labyrinth seals plus two piston rings . . . cut oil and maintenance costs down as they've never been cut before.

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LAYING BLACK TOP?



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- 50% More Traction,
- No Load on New Material,
- Adjustable 9 to 14 Ft. Widths,
- Blends Perfect Joints,
- Capacity to 1000 Tons a Day,
- Lays Hot or Cold Bituminous, Stone or Macadam,
- Pug Mill Spreader,
- Less Hand Finishing,
- Automotive Construction,

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THE JAEGER MACHINE CO.
701 Dublin Ave., Columbus, Ohio

JAEGER

New Diamond Drill For Grout Hole Work

A new diamond drill, known as the Explorer, adaptable to all types of exploratory drilling within its range, either from the surface, or locating or following a vein underground, and for grout hole work has been announced by Ingersoll-Rand Co., 11 Broadway, New York City. The light-weight drill head weighs 100 pounds, is of the screw speed type and affords three speed rates and neutral by use of an external gear selector. The external feed nut stop locks the feed nut for feed screw return. The length of the feed is 26 inches. Lubrication is through external industrial-type grease fittings and grease and dust-tight seals protect the enclosed mechanism.

The drill is operated by an air motor and frame assembly which weighs 120 pounds including the clamp bolts for mounting the drill on any standard mine column. The air motor is a standard I-R 4-cylinder unit with throttle valve speed control and combination splash and force feed lubrication. If electric drive is desired, splash-proof motors of 3-hp using alternating current on 110, 220, 440 or 550-volt, 3-phase, 60-cycle circuits are available. For gas engine drive a heavy-duty, single-cylinder, 4-cycle, air-cooled gasoline motor of 4½- to 6-hp is used, equipped with an impulse coupling magneto for easy starting. The motor weighs 175 pounds.

Heat-treated aluminum alloy castings are used for the frame and housing of the drill, giving equivalent strength with one-third the weight of cast-iron for these parts. If the diamond bit strikes a hard rock strata that cannot be drilled as rapidly as the feed screw is advancing, a set of friction rings allows the feed to slip, thus protecting the mechanism from overload and the diamond facing of the bit from damage.

Highway Construction Biggest Market for Steel

Although there is an increasing demand for structural steel for buildings and other similar private work, highway construction continues to afford the most important market, according to an analysis of business recently completed by the American Institute of Steel Construction.

During 1936 the structural steel fabricating industry produced over 1,600,000 tons of fabricated structural steel. Of this 37 per cent went into bridges, including railway as well as highway bridges; 25 per cent into buildings; and a little better than 22 per cent into the erection of new industrial plants. Exclusive of bridges, only about 3 per cent went into engineering projects. The remainder, approximately 13 per cent, constituted the odd jobs generally classified as miscellaneous.

WON'T QUIT or cause time out



A Hayward Bucket keeps the job going ahead on scheduled time. It won't quit or cause time out.

The Hayward
Company
32-36 Day Street
New York, N.Y.

Hayward Buckets



The New I-R Explorer Drill Working
on Grout Holes

A New 2¾-Inch Vibrator Hydraulically-Operated

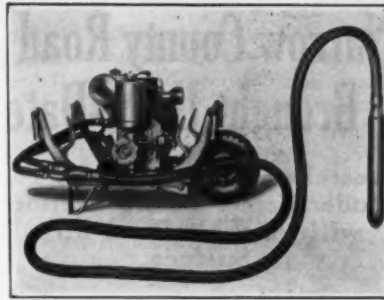
The new Jackson hydraulic vibrator, recently announced by the Electric Tamper & Equipment Co., Ludington, Mich., is a vibrating unit consisting of a 2¾-

inch diameter by 21-inch casing, enclosing a compact, powerful hydraulic turbine directly connected to the vibrating element. The hydraulic medium consists of light-bodied lubricating oil which operates in a closed circuit and circulates at approximately 20 gallons per minute.

A small rotary pump directly connected to a 3½-hp air-cooled gasoline engine or electric motor drives the oil through the system. All bearings and turbine parts are completely submerged in oil which circulates throughout the entire vibrator assembly.

The specially constructed hose equipment has an oil-proof synthetic lining and abrasion-resisting rubber casing of tire-tread stock and, for a greater portion of the lines, the pressure hose operates inside the flexible handle which also serves as the return oil circuit. The oil is filtered every cycle of circulation and remains in good condition for continuous use for long periods of time without changing.

All variations in pressure and load react directly on the engine governor

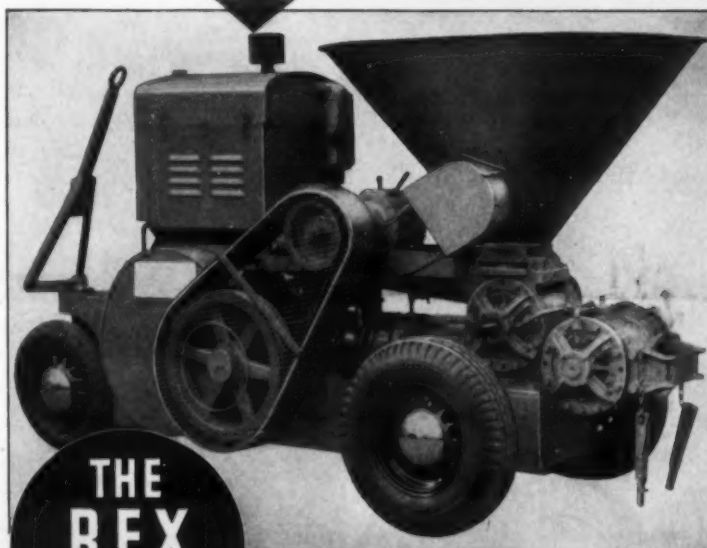


The New Jackson Hydraulic Vibrator

and no additional governing device is required. The frequency of the vibrator is always in direct ratio with the engine speed, regardless of whether the spade is running free or fully loaded. Frequencies of 3,000 to 7,000 per minute, submerged, are obtainable by adjustment of the engine governor.

This Hydro-Spade unit weighs 200 pounds, is 42 inches long, 24 inches wide, 27 inches high, and has 34 feet of hose.

HERE'S what you've been waiting for



THE
REX
160

A SMALL, LOW COST CONCRETE PUMP!

Here's the Pumpcrete that will help you get more small jobs per year—do them faster—and at a greater profit. It is light—fast moving—low cost—in answer to the demand for a small Pumpcrete that is designed and built specifically for jobs of less than 5000 cubic yards. It will deliver from 15 to 20 cubic yards per hour into the forms—cheaper, faster and easier—on a wider variety of jobs and it's backed by Pumpcrete's reputation of over 4,000,000 yards placed in less than five years.

This new Pumpcrete Catalog contains complete information on the design and operation of the Rex Pumpcrete. There's a 26-page rotogravure section that shows the Rex Pumpcrete in action on every size and type of job—with statistics on the yardage placed and the setup used. It has a list of Pumpcrete users that reads like the "Blue Book of American Contractors." It includes everything from pipe line handling to specifications. Read it—and be convinced that it pays to forget the old stuff in favor of the Rex Pumpcrete.

See our representatives or write our home office for your copy of this catalog and for further information on the new Rex 160 Pumpcrete. When writing, please give your name, your company's name and your present position.

CHAIN BELT COMPANY, 1666 W. Bruce St., Milwaukee, Wis.



REX PUMPCRETE

Narrow County Road Brought Up-to-Date

Westchester County, N. Y., Modernizes 4.3-Mile Section with Asphalt Road-Mix Surface

(Photo on page 56)

WESTCHESTER County, New York, located within easy commuting distance of New York City, found itself confronted, as most counties are, with a large mileage of narrow, out-worn roads. A typical example was a 4.3-mile section of old penetration macadam at Kitchawan in the west central part of the county. During 1936 this antiquated link in its highway system was very effectively modernized at a comparatively low cost.

Preparation of Old Road

The width of the old road was increased to 18 feet by placing at each side a widening strip consisting of broken stone. Portions of the penetration macadam which were below the desired grade and crown then were built up by means of wedge courses. A layer of $\frac{3}{4}$ to $1\frac{1}{2}$ -inch broken stone was spread to a maximum loose depth of approximately 3 inches and rolled down to 2 inches. This wedge course received an application of hot asphaltic cement at the rate of one gallon per square yard. In places where the old road had to be built up 5 to 6 inches, several successive layers of stone were laid and penetrated with asphalt.

Where the surface of the old road came to the desired grade and cross section, it was given a prime coat of bituminous material at the rate of 0.6-gallon per square yard.

Asphalt Road-Mix Surface

After the completion of these preliminary steps, the old road was ready for its new wearing surface, a low-cost asphalt top of the road-mix type having a compacted thickness of 2 inches. Stone for the surface was delivered by barge at Ossining, N.Y., on the Hudson River and trucked to the job. By means of a box spreader the stone was deposited on the old road in a windrow 10 feet wide. Texaco cut-back asphalt, meeting New York State Specification Item 69M, Grade A cut-back, was applied to the stone at the rate of one gallon per square yard in a single application. The cut-back asphalt and stone were mixed thoroughly by two motor graders until the stone was uniformly coated. Then, with the graders supplemented by hand forking, the mix was spread over the road and shaped to the desired contour.

After light rolling with a 10-ton roller to give the surface its initial compression, chinking chips were distributed at the rate of 20 pounds to the square yard and broomed into the voids. Rolling was resumed and continued until the surface had set up and become thoroughly consolidated. On the following day a seal coat of the same grade of cut-back asphalt used in the road-mix surface was applied at the rate of $\frac{1}{4}$ -gallon to the square yard. A covering



Mixing Stone and Cut-Back Asphalt with a Blade Grader

of stone chips followed, consisting of 20 pounds to the square yard, and the road received another thorough rolling. Finally a very thin coat of cold-laid asphaltic concrete was spread and rolled to give a smooth, uniform surface.

Using two graders in building the asphalt road-mix surface, the Peckham Road Construction Co., of White Plains, N.Y., was able to complete approximately $\frac{1}{2}$ -mile per day. Charles Sells is County Highway Superintendent.

Owen Bucket Announces New Eastern Sales Manager

Announcement has been made by the Owen Bucket Co., of Cleveland, Ohio, of the appointment of Philip T. Robin as Eastern District Manager in charge of the New York office and warehouse at 36-25 22nd St., Long Island City, N.Y. Mr. Robin has had more than 14 years of practical experience in the engineering and sales of clamshell buckets and related equipment.

New Md. Representative For Rock Asphalt Inst.

The Kentucky Rock Asphalt Institute has appointed George Hubbard Massey, of McLean, Va., as its representative in Maryland and the District of Columbia. Mr. Massey has been employed by the PWA for about three years, prior to which he was consulting engineer for various engineering projects, mostly in Virginia with headquarters at Norfolk.

KOEHRING

251

PULL SHOVEL

Flexibility of the Koehring 251 Excavator assures a wide range of profitable operating application. Converting for pull shovel operation is easily and quickly accomplished. High speed operation and selective swing speeds are important features for high production on trench jobs.



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USED ARC WELDERS FOR SALE AND FOR RENT

All types and sizes. Rebuilt, also unreconditioned welders at enormous savings.

Ask for free listing.

THE LINCOLN ELECTRIC CO.
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The Cavalcade of Diesel

This is the title of an unusually interesting and attractive booklet written by John B. Kennedy after an extensive and intensive trip made by him to the various manufacturers of diesel engines in this country, in preparation for his role as speaker at the luncheon held last December on the fortieth anniversary of the production of the first commercial diesel engine. The facts he gathered and

the things he learned about diesel power and its place in industry today are presented in this booklet from the point of view of the layman, but a layman with the ability to dramatize the things he sees and hears.

The rise of diesel power to a place of prominence has been so rapid that it is difficult to keep pace with it. The highlights of this cavalcade are touched upon in this booklet, copies of which may be secured gratis by readers of **CONTRACTORS AND ENGINEERS MONTHLY** from the Caterpillar Tractor Co., Peoria, Ill.

CONTRACTORS AND ENGINEERS MONTHLY from the Caterpillar Tractor Co., Peoria, Ill.

Mediterranean Road Opened

The new road along the Libyan coast from the Tunisian to the Egyptian border has been completed and formally opened to traffic by the Premier of Italy. The road is about 1,132 miles long and 22 feet wide. Of this mileage, 494 miles were constructed during 1936. The com-

pletion of this route, according to a report from the U. S. Bureau of Foreign and Domestic Commerce, makes it possible to motor the entire route between the Strait of Gibraltar and Cairo, Egypt, over first-class roads, except for a short distance along the seashore in northern Egypt, and the route is passable on through Egypt to Palestine and Syria where it connects with the desert route to Baghdad and from there to Teheran, Iran.



LeTourneau 12-Yard Carryall delivering load to the tractor hopper. Note that quick mounting of Bull-

GRAHAM BROTHERS Move 150 Tons of Aggregate Hourly With a Single 12-Yard

**ACTUAL
JOB DATA**

8-Yard Carryall loading sand from storage.



When other methods of handling material proved unsatisfactory, Graham Brothers, operators of seven aggregate plants in Southern California, tried a LeTourneau 12-Yard Carryall and "Caterpillar" Diesel. Today, at their El Monte plant, LeTourneau equipment and tractors profitably handle the entire operation from excavating to stock-piling. The original 12-Yard Carryall and tractor digs and delivers to the plant an average of 150 tons hourly on a long and short haul that runs up to 1,200 feet. A LeTourneau Bulldozer mounted on the same tractor prepares drive-ways and handles the harder digging; an 8-Yard Carryall does the stock-piling.

Ask your "Caterpillar" tractor dealer to demonstrate what this flexible setup of LeTourneau equipment and "Caterpillar" tractors can do for you.

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Manufacturers of: Angledozers*, Buggies*, Bulldozers, Carryall* Scrapers, Cranes, Drag Scrapers, Power Control Units, Rotters*, Treedozers.

*Name registered U. S. Patent Office.

Motor Truck Models Completely Changed

A complete new line of International motor trucks consisting of 25 models, 77 wheelbases, and sizes ranging from ½-ton to 10 to 15-ton six-wheeler models, has been announced by International Harvester Co., 606 So. Michigan Ave., Chicago, Ill. This is the first time that the International motor truck line has been so completely changed at one time. Not only have many engineering improvements been incorporated in the design of these new motor trucks to make them sturdier and more economical to operate, but much thought has been devoted to streamlined styling. The first series of these new trucks was given various engineering department tests and then sent out on the road and given a most severe set of road tests by the sales department.

These new Internationals provide standardized S.A.E. cab-to-rear-axle dimensions which are necessary to body interchangeability, and they also permit mounting of standard-length bodies of stock sizes. All International truck engines are designed and built for truck service. The types FA and FB valve-in-head engines which power the 2-ton and larger Internationals have replaceable cylinders; counterbalanced, vibration-damped crankshafts; full-pressure lubrication; precision-type, replaceable-shell, main and connecting-rod bearings; hardened exhaust-valve seat inserts; downdraft carburetion; scientifically designed manifolds; oil-bath air cleaners; air-cooled generators; and other outstanding features. The HD type L-head engines, which power the ½ and ¾-ton models, have a displacement of 213 inches and the engine in the 1½-ton models has a displacement of 232 inches.

Hydraulic brakes are standard equipment on all International models from the light delivery units to the 4 to 5-ton double-reduction drive Model DR-60. These internal-expanding, self-energizing, two-shoe, hydraulic brakes provide maximum stopping ability for heavy loads. Standard equipment on the larger units includes factory-installed booster brakes of the vacuum-suspended type. Air brakes are standard equipment on the Model DR-70 and the larger 6-wheel units. These trucks have full-floating rear axles, except on the ½-ton models; roller-bearing, anti-friction-type universal joints; self-aligning propeller-shaft center bearings on the long wheel chassis; and other features.

The trucks have new all-steel cabs which are roomy, providing ample leg and head room.



Testing the New International Trucks On the "W" Route Up Signal Mountain Near Chattanooga, Tenn.

A One-Man, All-Steel Stone and Chip Spreader

Two types of chip and stone spreaders, the same in general principle but differing in that Model A remains attached to the truck and Model D is adapted for

use on more than one truck, have been announced by the Temple Stone & Chip Spreader Co., 2335 Kutztown Rd., Reading, Pa.

The Temple spreader delivers any specified weight of material per square yard in any width from 6 inches up to 8 feet and with the truck moving forward or backward. It will handle any size of road material from sand to ballast, dropping the material directly into place and not thrown to the side. It consists of a steel hopper with a gear control gate and a safety seat for the operator. The spreader replaces the tail-gate on the dump truck and is readily attached or detached in about five minutes time without any alterations to the motor truck body. No power mechanism is necessary for spreading the material and the spreader itself is attached to the truck with three bolts in the bottom of the truck and two in each side of the truck body. The spreader must stand at right angles to the road surface when the truck body is up or in spreading position.



Spreading a 4-Foot Strip with a Temple Stone Spreader.

The unit is substantially built of heavy steel plates and cast steel fittings braced and reinforced with a truss rod and a turnbuckle on the under side for taking up any sag and keeping the opening of the spreader uniform at all times. The control gate of the spreader is 8 feet wide and 9 inches high.

WHEN BIG JOBS NEED DOING *Cletrac does them*



*10 Cletracs move
a river 1000 feet*



Two Cletracs with wagons excavating the new river channel

Bulldozing earth to a levee parallel to the new river channel

ALL WINTER "The Battle of the Mud" has been aggressively waged in the Cuyahoga River valley of Cleveland, with a fleet of Cletracs operating under the worst possible conditions one can imagine.

To begin with, the river bed was moved 1000 feet. Then, the entire area had to be raised ten feet above the normal valley level. This required the movement of 750,000 cubic yards of earth. Here was a big job in itself.

But to make conditions worse, the winter

was an open one—freezing, thawing and raining continuously. At one time floods came and water covered the entire area.

But day and night—rain or shine—thawing or freezing—flood or no flood—ten Cletracs carried on. Without Cletracs and crawler wagons the job would have been impossible.

Where last year a river flowed, there now rises the steel framework of a giant mill—the largest continuous strip mill in the world—a mill that will be completed on time because Cletracs carried through.



A modern mill begins to rise on the fill

THE CLEVELAND TRACTOR COMPANY • Euclid Avenue, Cleveland, Ohio



WEATHERPROOF

Dixon's Waterproof Graphited Grease, the superior adhesive lubricant, is really weatherproof. Wherever you have cables, gears and other machinery that are exposed to weather and excessive dust—use Dixon's. Unaffected by rain, acid or alkaline waters. Prevents rust and "stays put" at highest speeds.

At supply houses everywhere or write for Booklet W-148.

JOSEPH DIXON CRUCIBLE CO.
Jersey City, N. J.

AND WHAT A HELP THESE ARE



SEND FOR CIRCULARS

O'Shaughnessy Dam Concreting Plant

(Continued from page 2)

veyor which crosses the canyon to the central aggregates plant. It is the intention to replace the cableway with a 30-inch suspended conveyor. The high line is a single span of 1,946 feet of 2½-inch diameter 6 x 19 cable, with 4-part lift. The skip has a capacity of 7 cubic yards and travels at the rate of 800 feet a minute. The head anchorage is an eye bolt set in the granite. The tail tower is a timber structure 80 feet high.

The skip dumps to a stockpile under which is a conveyor in a tunnel. A 30-inch feeder loads on to a 36-inch inclined belt which carries the material to the first rotary classifying screen. This separates the material greater than 6-inch in size and passes all other sizes suitable for grading. At this point heavy streams of water take care of the first washing.

The oversize material is discharged at the end of the screen and passed back to two secondary jaw crushers for re-crushing. The main belt feed to a series of four shaker screens carries the discharge from both the rotary screen and the secondary crushers and the material is again sprayed and separated into four separate stockpiles. The first take-off is 3 to 6-inch sizes, the second 1½ to 3-inch, the third ¾ to 1½-inch and the fourth ¼ to ¾-inch. All crusher sand and fines are wasted.

Should a deficiency occur in any of the stockpiles during the operation of the plant, material may be drawn from the 3-inch or the 1½-inch screen and circulated back to a 3-foot Symons cone crusher for re-crushing to the smaller sizes. The material is then conveyed back to the main belt feed and passes through the shaker screens again. The capacity of the screening plant is 100 cubic yards an hour.

Each stockpile from the different shaker screens has a live storage of 5,000 cubic yards. From each aggregate pile the material is drawn off by means of a belt conveyor through a tunnel. These belts in turn empty on to a main belt which carries the material to a large steel collector cone over the mixers. The cone is divided into five compartments as follows:

Sand	300 Cubic Yards
3 to 6-inch rock.....	300 Cubic Yards
1½ to 3-inch rock.....	200 Cubic Yards
¾ to 1½-inch rock.....	200 Cubic Yards
¼ to ¾-inch rock.....	200 Cubic Yards

From this bin all materials are fed to the mixers by gravity. The reciprocating belt feeders were made by the Bodinson Mfg. Co., the troughing rollers for the belt conveyors are Rex-Stearns and Jeffrey and the belting made by the B. F. Goodrich Co. and the U. S. Rubber Co. Falk gear reducers are used. A C. S. Johnson batching and recording system is used throughout.

Cement Handling

Cement is delivered in bulk by rail at Mather, 9½ miles from the site of the work. It is there unloaded by scraper to a hopper and, passing through a 14-inch screw conveyor and bucket elevator, is stored in a 5,200-barrel steel silo. From this storage point, two 16-ton capacity specially constructed trucks deliver the cement to the construction site where they are unloaded by gravity. At the unloading point the trucks are driven out on a ramp and dump the cement into a small bin, at the bottom of which is a Fuller-Kinyon pump with a capacity of 130 barrels per hour. The cement is again stored in a 2,000-barrel steel silo elevated above the mixing plant. The cement is drawn from this silo and deposited in a small bin over the mixers by gravity and an 18-inch screw conveyor.

Concreting

Concrete mixing is done in two 4-cubic yard Davis mixers. From the mixers the concrete is deposited on the dam from 8-cubic yard skips handled by a Lidgerwood cableway with Smilie control. The main cable is 3 inches in diameter and has a 1,900-foot span which is anchored to granite on the north abutment and suspended from a 100-foot steel head tower on the south. Two auxiliary carriages running on parallel cables, one to each side of the main cable (the essential feature of the Smilie system), permit swinging the load laterally, giving a working latitude of about 270 feet. The main line is operated by a 400-hp motor. The working load is 25 tons and the rate of pour 1 cubic yard per minute.

The concrete placed is artificially cooled by a refrigeration system which has capacity to cool 350 gallons of water per minute from 47 degrees F. to 40 degrees F. Initial cooling is done by circulating the cold water from Hetch

Hetchy reservoir, after which refrigerated water is used.

Personnel

The construction of O'Shaughnessy Dam is an activity of the Hetch Hetchy Construction Department of the Public Utilities Commission of San Francisco. L. T. McAfee, Utilities Engineer, is in general charge. The author is in immediate charge.

New Catalog on Pumps

Cameron Motorpumps, ranging in capacities from 5 to 1,000 gpm for heads to 500 feet, are described and illustrated in a new catalog recently issued by Ingersoll-Rand Co., 11 Broadway, New York City. These pumps are compact machines combining electric motor and centrifugal pumps in a single unit, with motor sizes from ¼ to 40 horsepower.

Copies of this new catalog may be secured upon request direct from Ingersoll-Rand Co. at the above address.

PILE HAMMERS and EXTRACTORS HOISTS-DERRICKS WHIRLERS

Special Equipment
Movable Bridge Machinery

Write for descriptive catalogs.

McKIERNAN-TERRY CORP.
19 Park Row, New York
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"TOUGH JOB" LUBRICATION and 10 times more Diesel Service Hours with **SINCLAIR TENOL**

Reg. U. S. Pat. Off.

Have you "tough jobs" for your "Caterpillar" Diesels...bulldozing...heavy hauling...road building or power generation?

"Tough jobs"...all of them...and they call for good lubrication. Sinclair Ten-ol will give you amazing results on those jobs.

Ten-ol is a new fused lubricant developed by Sinclair for "Caterpillar" Diesels. Its use

will mean a tremendous saving in your Diesel operation...ten times as many service hours without overhaul shutdown as with the finest straight mineral oil.

Order Sinclair Ten-ol, Sinclair Diesel fuel, and other Sinclair products from your local Sinclair office or write Sinclair Refining Company (Inc.), 630 Fifth Avenue, New York, N. Y.

Copyrighted 1937 by Sinclair Refining Company (Inc.)

Sinclair TENOL is recommended as a "new outstanding Diesel engine lubricant" by Caterpillar Tractor Co.

Fundamental Principles Of Reinforced Concrete

Volume 1 of the fourth edition of Hool and Pulver's "Reinforced Concrete Construction" has just been published. This volume presents the fundamentals of reinforced concrete construction in two parts: the first giving details and data on materials, covering the materials comprising concrete, proportioning, manufacture, the properties of concrete and chapters on steel, and concrete and steel in combination. Part

two, on the theory and design of slabs, beams and columns, is divided into careful analytical discussions of simple rectangular beams, T-beams and beams with tension and compression reinforcement, restrained and continuous beams, slab, cross-beam and girder floors, simple rectangular flat slab floors, columns, single column footings, bending and direct stress, and concludes with a chapter of tables and diagrams giving the values of constants in the formulae for the various types of beams and an appendix devoted to discussions of shear and moment in continuous

beams.

The book is published by the McGraw-Hill Book Co., Inc., New York City. Price \$4.00.

Harper to Handle A.R.B.A. Publicity

The American Road Builders' Association has announced the appointment of Robert E. Harper of New Orleans, La., as its new director of publicity. Mr. Harper is 28 years old, a graduate of the University of Alabama, and has

been for the past two years associated with the New Orleans office of the Shell Petroleum Corp., where he was engaged in sales promotional and advertising activities. He has also been associated with four of Louisiana's newspapers and done free-lance publicity and advertising work.

His new duties in Washington will be to publicize the activities of the Association, as well as to serve as Editor and staff artist for the "Road Builders' News," official publication of the Association, the first copy of which was issued early in May.

TOO GOOD TO TRADE IN AFTER WORKING

15



24th DIESEL DOING ITS SECOND 10,000 HOURS

Another early owner of a "Caterpillar" Diesel has operated his for more than 5 years—and it's *still too good to trade in*. This machine has been worked 12 to 20 hours per day, mostly with an elevating grader. Fuel and lubrication cost less than 35 cents an hour. No wonder Harold Petersen hasn't parted with it!

Austria Pushes Road Building

A new road construction program for Austria has been authorized for 1937 and 1938, providing for repairs and construction over a large part of the Austrian highway system. Hard surfacing is planned for 175 miles. For this work, about 11,000 people will obtain permanent work and some 5,000, seasonal employment. The cost of these road improvements will be provided from a part of the proceeds of the 180,000,000 schilling (\$33,725,000) investment loan now under subscription, ac-

ording to a report from the U. S. Bureau of Foreign and Domestic Commerce.

Vehicle Registrations Set New Record in 1936

Motor vehicle registrations in the United States reached an all-time high in 1936, exceeding the 1935 registration by nearly 2,000,000 and surpassing the former all-time high of 1930 by 1,700,000 vehicles, according to reports of state authorities to the Bureau of Public

Roads of the U. S. Department of Agriculture. Registrations in 1936 totaled 28,221,291, comprising 24,197,685 passenger vehicles and 4,023,606 trucks and tractor trucks.

Every state showed an increase in registrations over the previous year. Registrations in sixteen states increased more than 10 per cent over 1935 figures and the average increase for the United States amounted to 7.6 per cent.

Registration receipts and miscellaneous receipts amounted to \$359,783,000. Trucks and tractor trucks composed less than 15 per cent of the registrations but

accounted for nearly 24 per cent of the receipts.

New Sales Engineer For Toncan Culvert Association

H. P. Pickering, formerly in the engineering department of the Santa Fe Railroad, and since connected with the U. S. Bureau of Public Roads, has joined the Toncan Culvert Manufacturers' Assn., Republic Bldg., Cleveland, Ohio, as Sales Engineer for the Association.

000

HOURS!

ONE OF THE FIRST DIESEL TRACTORS NOW BUILDING THE FIRST TRANSATLANTIC AIR TERMINUS

This tractor—the 4th Diesel built by Caterpillar Tractor Co.—was bought way back in 1931 by the Arundel Co. of Baltimore, Maryland. It has done over 15,000 hours of heavy-duty work and is still too good to trade in.

HERE'S A SKETCH OF ITS HISTORY

BOUGHT IN NOVEMBER, 1931—WORKED:

At Bolling Air Field, Washington, D. C., pulling scrapers and heavy iron drag.

Pulling wagons on Maryland road contract.

Pulling wagons on another Maryland road contract.

Pulling wagons on a bridge job.

On sewer job in Washington, D. C.

On cemetery job in Baltimore.

On a railroad job near Zoar, Ohio.

Much of this work was double-shifted.

LATEST JOB—working with bulldozer on Transatlantic Air Base at Baltimore.

Its operating savings paid its cost years ago, and it is still earning at the same rate.

LOOK at the records of these veterans—and you'll understand why thousands of owners brag about the long life of their "Caterpillar" Diesel Tractors. Many have worked ten, fifteen, or twenty thousand hours! That's why 83 leading manufacturers use the same engine to power their products. No wonder owners say that Diesel savings are continuous savings—low fuel and up-keep costs that earn profits for years!

Ask your dealer to give you the record-breaking operating costs of "Caterpillar" Diesels on jobs similar to yours. Compare them with your costs—and let him show you how Diesel power can increase your profits.

CATERPILLAR TRACTOR CO.

PEORIA, ILL.

REG. U.S. PAT. OFF.



WORLD'S LARGEST MANUFACTURER OF DIESEL ENGINES,
TRACK-TYPE TRACTORS AND ROAD MACHINERY

New Blasting Agent Tested in Big Shot

The largest blast of Nitramon made thus far furnished a test for this blasting agent at the John T. Dyer Co. trap rock quarry at Monocacy, Berks County, Penna. This shot on April 17, which was designed to move approximately 250,000 tons of rock, is estimated to have brought down actually around 300,000 tons, with 54,463 pounds of Nitramon.

Loading began on April 14 and was supervised by technical men from E. I. du Pont de Nemours & Co., of Wilmington, Del., maker of Nitramon. Two tunnels 4 x 4 feet in section at the bottom of the quarry and ten well-drill holes at the top of the quarry were used. Tunnel No. 1 had an adit 56 feet long with two laterals, the eastern lateral 40 feet and the western one, 98 feet. Tunnel No. 2 had a 50-foot adit with an eastern lateral of 88 feet and a western lateral of 60 feet. The length of the shot was estimated at 347 feet with an average height of 120 feet and burdens ranging from 50 to 90 feet. A total of 47,343 pounds of Nitramon was placed in the two tunnels, and the remainder in the well-drill holes.

The two tunnels were loaded in six hours. The cans of Nitramon were trucked from the car to the tunnel and wheelbarrowed into each unit of the load as needed. No stemming was used between the charge units. After the electric blasting caps were placed, back-filling of the adits was completed. The ten well-drill holes, varying in depth from 35 to 113 feet, were loaded with from 8 to 43 cans of Nitramon. Each hole was primed with a Nitramon primer and double-countered Cordeau. An electric blasting cap was connected at each hole to a Cordeau fuse. The caps from the well-drill holes were connected in with the circuit to the two tunnels, each of which had 14 caps per tunnel. All connections were in parallel.

Care was taken with warning signals for the blast, since there was a crowd of onlookers. A locomotive whistle blew three times, after which a stick of dynamite was fired as a further warning. Fifteen seconds later, the switch was pulled and the shot fired.

The tunnels moved out the rock as expected, according to the plans of the technical men, and the results were entirely satisfactory. There were 60 feet between the east lateral of Tunnel No. 1 and the west lateral of Tunnel No. 2 and this 60-foot gap apparently was cut through by the shot. There were approximately 6 tons of stone for each pound of Nitramon displaced by the blast. Fragmentation was good, as far as could be determined. Quarry officials stated that the blast will supply enough rock to keep the company's sixty-five men occupied for one year.

Mack Announces Its Lightest Truck

Rated at 16,000 pounds gross, the new Model EJ, just announced by Mack Trucks, Inc., Long Island City, N. Y., is the lightest truck yet built in the regular Mack line. It is available in four wheelbases ranging from 146 to 194 inches. Three tractor wheelbases are available ranging from 139 to 158 inches. The maximum size tire used is the 8.25-20.

A six-cylinder engine with $3\frac{1}{2} \times 5$ -inch bore and stroke powers this model. The engine has a piston displacement of 288 cubic inches and develops 84 hp at the governed speed of 2,800 rpm. Drive is from a dry single plate clutch through a five-speed unit-with-engine transmission with direct drive in fifth as standard, an over-gear fifth being available at slight extra cost. The final drive on this model is of the single reduction spiral bevel type with three available

ratios: 4.86, 5.83, and 6.80.

The four-wheel foot-brakes of this model are hydraulic and vacuum booster actuated with a braking area of 370 square inches. The chassis frame is pressed carbon steel with a depth of 8 inches, a width of $\frac{1}{4}$ inch, and a $3\frac{1}{4}$ -inch flange.

Golden Chains Severed In Official Bridge Opening

At the dedication ceremonies for the Golden Gate Bridge, officials of the Victor Equipment Co., including L. W. Stettner, President; E. L. Mathy, First

Vice President; and W. S. Fulwider, Secretary-Treasurer, directed the hands of Mayor Rossi, President Filmer and Director Doyle of the Golden Gate Bridge and Highway District as they wielded the Victor oxy-acetylene torches in the symbolic climax of cutting the golden chain barrier.

Bucket STYLES CHANGE ALSO

Get latest Information about **ADVANCED MODELS**



in this **NEW OWEN CATALOG**

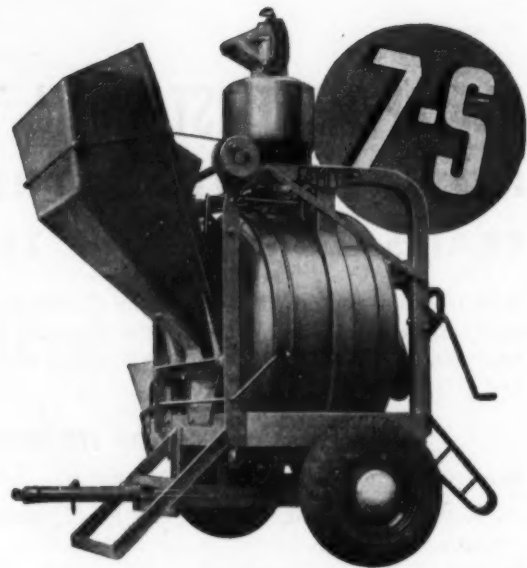
THE OWEN BUCKET COMPANY
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 BERKELEY, CAL.



Faster streamlined mixers!

ENGINEERED LIKE YOUR MOTOR CAR

These new Smith Mixers are the "Tops". Modern in appearance—modern in design—modern in performance. So easy to move, yet husky brutes, able to take hard everyday punishment for years. Try a Smith on your next job. You'll appreciate its speed — thorough mix and, above all, PROFIT EARNING ability.



TRAIL-SMITH

Compact, lightweight trailer mixer. Tows behind car or truck at fast driving speed. Equipped with spring-mounted axle and new roller bearing automobile type wheels with oversize low pressure pneumatic tires. Automatic skip vibrator. Enclosed gear reduction. Multiple V-belt drive. Vertical syphon-type water tank. Roller bearings throughout.

MOVE IT FAST — MOVE IT OFTEN

All sizes of mixers available.
Write today for literature.

THE T. L. SMITH COMPANY
 2857 North 32nd Street Milwaukee, Wisconsin

SMITH MIXERS

THE BOULDER DAM MIXERS

Final Excavation in Sand and Rock for All-American Canal

Finishing Touches for Huge Irrigation Project Speeded by Contractors Along 8-Mile Front

By JOSEPH C. COYLE

OVER 60 miles of the All-American Canal, which is to irrigate Imperial Valley in southern California, has been excavated to date. Early progress was described in the July, 1935, issue of **CONTRACTORS AND ENGINEERS MONTHLY**. The Griffith contract at Pilot Knob, and force account schedules near Calexico have been completed. A short bit of the Boyce-Igo contract has to be finished later, the firm having moved to another job nearby. Some river crossings and turnouts remain to be let near Calexico, and Peterson Construction Co., of Minneapolis, is excavating 740,000 cubic yards of canal on that end, for \$54,862. The dirt is cast direct, using a Bucyrus 50-B and an Osgood Chief dragline.

East of the irrigated valley, 23 miles of the canal is through a sandy mesa, dotted with small dunes. The last 6 miles of this was let to Mitty Brothers of Visalia, Calif. for \$260,400, and subbed to the W. E. Callahan Construction Co. of St. Louis, and Gunther & Shirley of Omaha. A 6-W Bucyrus-Monighan walking dragline, with oversized bucket, is used, supplemented at times by a smaller machine from another job.

Between this and the sand dunes, where Callahan's original 30-mile contract begins, 17 miles of the big ditch is being dug by Lewis-Chambers Construction Co. of New Orleans, for \$505,506. A 5-W Bucyrus-Monighan walking dragline, with a 7-yard bucket, and two smaller machines, both Bucyrus-Erie, are used separately. The main excavation is usually made in two cuts, the machine going ahead for some distance and then walking back for the second cut. Direct casting is the rule, except at drops and highway crossings, where no dumps may be made within 200 feet of the structures, necessitating some rehandling. As the mesa floor must be bond-plowed wherever it comes below the water line, the dunes are stripped off before making the main cut. Through the larger dunes this is done for 20 feet back of the cut stakes. Plowing is done with an Oliver two-bottom farm lister, strengthened by welding. Lewis-Chambers' draglines are all diesel-powered, and except for about a mile of the excavation has permitted the use of buckets without teeth.

The berms are leveled and the machines serviced by Allis-Chalmers tractors, equipped with Baker bulldozers. After finishing the canal slopes to neat lines with the smallest dragline, the tractors smooth the surface with a 1½-inch steel cable dragged between two of them.

Because of the loose sand the use of ordinary automobiles is impractical, so both contractor and government forces use light cars, stripped down and fitted with oversized tires for transportation about the job. These are called "sand fleas", and when kept moving they ride the dunes very well. A shop for welding and light repairs is maintained at the job. There is a Hansen arc welder, mounted on a light auto chassis, and an Airco acetylene outfit.

Cleaning Up 33,000,000 Yards
W. E. Callahan Construction Co. and

Gunther & Shirley are still active at both ends of the original contract of 39,390,000 cubic yards. About 34,000,000 yards of this have been removed to date. One crew, with a Bucyrus-Monighan 10-W walking dragline, and a 6-W of the same make and type, are now in the sand dunes, scooping the blow sand from the deepest section. With a maximum depth of 100 feet to the mesa floor, at one point, considerable rehandling is being done to bring the banks to the specified slope. A 16-cubic yard bucket on the 10-W and a 9-yard bucket on the 6-W expedite removal of the light sand. The usual procedure is to strip off this blow sand for a distance of about 1,000 feet,



One of the Big Monighan Draglines Which Is on a Night and Day Schedule on the Callahan-Gunther & Shirley Section of the All-American Canal. A Caterpillar Diesel Generator Set Furnishes Power for Lighting.

then walk back and rough out the channel with the two machines, the smaller one working from one berm. The 6-W
(Continued on page 42)

Good Engineering and Good Products Make Good Roads



Socony Binder B Bituminous Macadam, Standard Brand, Hammond Pond Parkway, Newton, Massachusetts.

Socony Asphalt Road Oils · Socony Asphalt Joint Fillers ·
Socony Waterproofing Asphalt · Socony Cut-Back Surfacing Asphalt · Socony Asphalt Binder A for surface treatment · Socony Refined Asphalt for sheet asphalt paving · Socony Cold Patch Asphalt for all types of patching · Socony Asphalt Binders B & C for penetration work (Asphalt Macadam) · Socony Paving Asphalt 51-60 and 61-70 Penetration for the mixing method (Asphaltic Concrete) · Specifications and all other particulars furnished on request.



SOCONY-VACUUM OIL Co.

INCORPORATED
STANDARD OIL OF NEW YORK DIVISION

Channel Change At Goshen, N. Y.

(Continued from page 1)

feet. To provide levees along certain portions of the project, a total of 1,500,000 cubic yards of muck, clay and quicksand was moved with 120 motor trucks. Generally, however, the channel excavation was placed in a continuous spoil pile, parallel to the channel, thus forming levees. The estimated cost of the entire project is between \$8,000,000 and \$10,000,000, including the cost of maintenance of the CCC companies which were engaged in this work.

Soil Conditions

The whole valley through which the Wallkill River meanders is covered with a rich black muck from 5 to 12 feet deep and having from 50 to 75 per cent voids. This insulation prevents frost penetration to any considerable depth. Beneath the black soil is a layer of jelly-like clay ranging in thickness from 18 inches to 3 feet. This treacherous layer has been the cause of many slides on the work and has made necessary certain rather unusual methods on the channel change section. Beneath the clay is 15 feet or more of a fine rock flour which when wet looks like clay and when dry looks like beach sand. This bottom material changes to a regular beach sand sometimes within 200 feet.

Excavating Equipment

The excavation was started with the 5/8-yard Speeder draglines but because of the magnitude of the work and the width of the excavation, these machines were supplemented with six larger units secured through a rental contract from the Ogden Contracting Corp. of New York City, Clem B. Hoppe, Secretary. These six machines included three Marion 371's with 70-foot booms and powered with Buda gas engines and three Koehring 702's with 65-foot booms and powered with Wisconsin gas engines. All six machines swung 1 1/2-yard Page dragline buckets.

The contractor moved in his machines early in April, 1936. Just two weeks before that date, the whole project had been covered with 10 to 12 feet of water. The first Marion dragline, then equipped with a 70-foot boom, was moved in, worked for three hours without mats and then was moved to more stable ground for the night. The next day the machine was moved back over the spot where it worked the preceding day and literally dropped into the soft ground where the road sheared, and sank to the floor of the cab. After that, every machine worked continuously on mats made of 12 x 12's and measuring 5 x 20 feet. As it was impossible to swing the mats close to the dragline, four of them were placed in front and then pulled in close with the bucket. The Marion and Koehring draglines worked 8 to 12 hours a day. All operators worked on 8-hour shifts.



Tractor Front End Attachments

Write for Circular on types, sizes and prices

White Mfg. Co.
ELKHART INDIANA

Checking Slides and Theories

In order to economize on right-of-way costs the Commission bought only a 400-foot right-of-way through the section where the channel change was made. With a top width of 140 feet, a 22-foot berm on either side and a spoil pile back of each berm, there was a great deal of wet excavation concentrated close to the ditch. This caused some unusual performances on the part of the excavated material. The jelly-like clay in many cases flowed out like water down into the excavated channel and along the channel bottom, causing a sinking in the roadway along the berm and sometimes a complete slumping of all of the material all the way from the spoil bank to the bottom of the channel, completely filling the excavated channel.

An interesting theory was developed by Col. H. C. Byrnes, Superintendent in charge of the entire project for the U. S. Engineer Department, regarding the mechanics of the slides. Up to last fall, the road had never had its initial sinking

spell until after a dragline had left the spot. It is believed that the weight of the machine created adequate friction so that the upper layer of muck did not slide over the bottom layer of clay until the removal of the machine reduced the load on the section. The operation of the machine with its vibration made the jelly-like layer of clay quite fluid. In fact, one of the tests for the solidity of the ground was to stand some 100 feet from the machine and if the vibration of the machine could be felt distinctly at that distance, it was assurance that a slide was developing.

One section 1,000 feet long slid completely into the ditch. On another section the whole spoil bank slid from behind the road into the channel, leaving the road practically in alignment and with a drop of not more than 3 feet. When slides occurred, the trucks were called in to load the road with gravel to maintain the grade. Gradually this layer of gravel sank and was made thicker until finally it formed a gravel

dam through the thin layer of clay and held back this material, preventing its flow into the channel. The roads on the berm were maintained by a fleet of Caterpillar tractors and LaPlant-Choate bulldozers.

Slackline Rig with Dragline Bucket

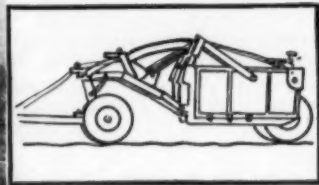
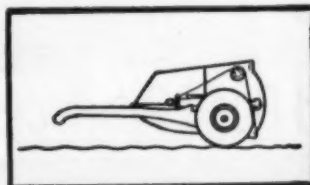
When digging in solid clay where it was necessary to keep the heavy ma-

(Continued on page 37)

**ROAD MATS
TARPAULINS
WINDBREAKS**

CONTRACTOR SUPPLIERS in every state sell the FULTON LINE. Ask for SHUREDRY and FULTON Tarpaulins and Windbreaks—anything made of canvas. Also Road Mats and Burlap. You buy quality products at fair prices when you buy the Fulton Line.

Fulton Bag & Cotton Mills
Manufacturers Since 1870
ATLANTA ST. LOUIS DALLAS
MINNEAPOLIS BROOKLYN NEW ORLEANS KANSAS CITY, MO.



SIMPLEST IN DESIGN— and all working actions!

Continental Wagon Scrapers are simplest in design and all working actions because they have no levers, cables, multiple sheaves, counterbalances, reels or gadgets to get out of order, wear, or require constant maintenance.

A two-piece body and rear door, mounted on a heavy duty frame, and actuated by two positive hydraulic jacks, plus the stability of two-wheeled design comprises a neat, rugged, fool-proof unit.

That's why Continentals are used on the toughest jobs—where the going is the heaviest. They out-work and out-last any dirt moving equipment made!

Built to dig and load anything the tractor will pull—they dig—load—and dump faster! Rocks, tree roots, or other imbedded objects are no hindrance.

Spotting the load—backing—back-filling—short turning—obstacles to other forms of dirt moving machines are easy jobs with Continentals.

No matter what your dirt moving work involves—cut and fill, leveling, grading, short hauls, or long hauls—Continental Wagon Scrapers will do it faster and at less cost.

Continental Wagon Scrapers are made for use with all crawler tractors in 5, 7 and 10 yard models, rubber tired or crawler mounted.

See your Allis-Chalmers dealer for complete Continental details!

CONTINENTAL ROLL & STEEL FOUNDRY COMPANY

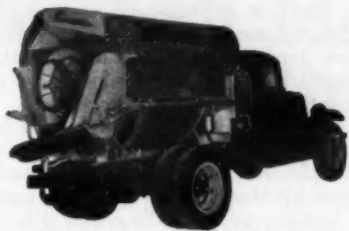
Tractor Equipment Division
Railroad Avenue
East Chicago, Indiana

8 other Continental features:

1. Lightest in weight, yet strongest!
2. Simplest in design and all working actions!
3. Require less tractor power!
4. Backfill entirely over a bank!
5. Dump in close quarters!
6. Turn short and back easily!
7. Load, dump and haul faster!
8. Used for spreading and grading, too!



CONTINENTAL WAGON SCRAPERS



The New Ransome Truck-Mixer

An Improved Truck Mixer And Agitator for Concrete

There are some interesting new features as well as the well-known characteristics of previous models in the new line of truck-mixers and agitators recently announced by the Ransome Concrete Machinery Co., Dunellen, N. J.

These new units embody the original Ransome mixing action, the same simplicity of design combined with sturdiness of construction, lightness in weight, strength of materials, ease and convenience of operation, and accessibility of parts. All essential parts are enclosed, protecting against cement dust and dirt. The three-point mounting of the drum combined with the flexible frame is designed to prevent misalignment.

The drum shell, mixing blades, charging and discharge doors are made of high tensile steel of the manganese type. The mixing blades are designed for non-clogging. The drum trunnion bearing takes no thrust load, all thrust being taken by flanges on the drum rollers. The top charging door is accessible from the side runway. The discharge door screw is entirely outside the drum, free from contact with the concrete and the discharge hand wheel is accessible from the rear, on either the right or left side.

The frame is an electrically welded unit, with substantial built-up steel sections providing the supports for the drum. One end of the drum revolves on trunnion SKF self-aligning roller bearings, the other end revolving on two drum rollers, each mounted on two Timken roller bearings. Two water reservoirs are mounted above the engine, one for the main water supply and the other for washing out the drum. An accurately calibrated dial is furnished for the main reservoir which measures the exact amount of water required for each batch.

The power unit, entirely independent of the truck motor, is mounted cross-wise on the frame end, equipped with right angle gear reduction, all gears fully enclosed and running in oil.

The truck mixers are furnished in capacities of 1, 1½, 2, 3, 4, and 5 cubic yards and the agitators are furnished in 1½, 2, 3, 4½, 6 and 7½-yard capacities.

Two New Centrifugals

New streamlined Humdinger self-priming centrifugal pumps, in a 6-inch Model 90M with a capacity of 90,000 gph and an 8-inch Model 125M with a 125,000-gph capacity, have been announced by the Ralph B. Carter Co., Hackensack, N. J.

Features of the 6-inch model are a 2¼-inch diameter shaft on a ball-bearing shaft support, flexible coupling drive, renewable wearing parts, heavy abrasive-resisting semi-steel castings and quick-opening handhole plates. Power is furnished by an 85-hp Carter-Ford V-8 industrial power unit, with force-feed lubrication, air cleaner, self-starter and special radiator cooling system, or by a Le Roi D201 40-hp four-cylinder unit with force feed lubrication and radiator cooling. The unit is mounted on four steel wheels of 24-inch diameter or four pneumatic tires, or on steel skids. Standard equipment includes a discharge elbow, lifting bail, and large-capacity galvanized wrought

iron Humdinger strainer.

The 8-inch model has the same features, is powered with a Carter-Ford V-8 85-hp unit or by a Hercules or Waukesha six-cylinder 65-hp radiator-cooled complete power unit. The mountings available are the same as that for the 6-inch model and the standard equipment is the same.

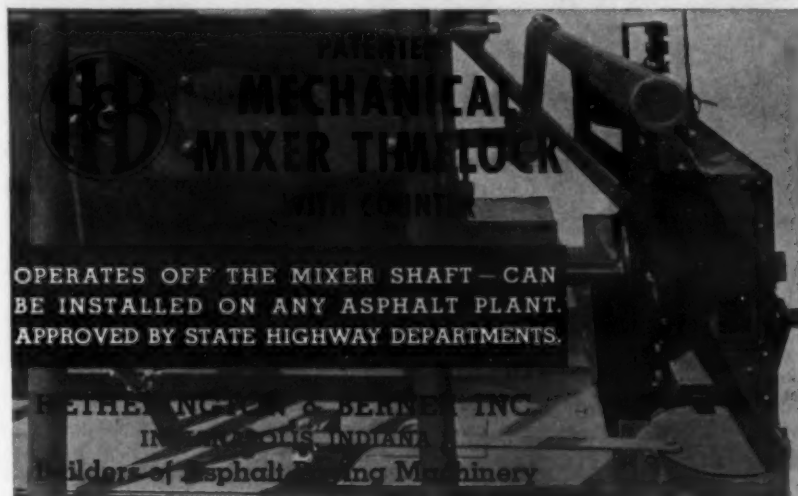
These two pumps, as well as other models of Humdinger pumps, are described and illustrated in literature which the manufacturer will be glad to send upon request.

Indiana's Pioneer Stretch Of Safety Lighting Dedicated

A mile of sodium safety lighting, sponsored by the Indiana Highway Commission and the first of its kind in the state, has just been put into operation on U. S. Route 20 at Michigan City. The G-E sodium vapor lights were installed by the Northern Indiana Public Service Co. to enable the Indiana

Highway Commission to study the new illumination and its effect on night traffic. The stretch of highway near Michigan City was chosen by the Com-

mission as an ideal location for a lighting demonstration because of heavy traffic, high accident frequency, and fog which is often a hazard on the highway.



"I've run my P&H on all kinds of jobs, digging basements, stripping and loading materials, and never had to worry how tough the digging was. We always got big production."
—N. S. Carpenter.

**NO GRABBING
NO DRAGGING
NO CHATTERING
WITH THESE
P&H SPLIT SECOND CLUTCHES**



P&H Pacemakers-FASTER ON THE JOB

● These split-second clutches have full floating, full releasing shoes, perfectly equalized. They can't grab or drag. Bands can't wear unevenly. You can "feel" the clutch at all times. It takes only a few minutes and a few cents to replace brake linings. The first excavators to use this better type of clutch are the P&H Pacemakers—built by the Harnischfeger Corp.

4419 WEST NATIONAL AVENUE MILWAUKEE, WISCONSIN

HARNISCHFEGER CORPORATION

EXCAVATORS • ELECTRIC CRANES • HOISTS • MOTORS • ARC WELDERS



COUNTY TRUCK REJUVENATED



When the Motor of One of the Trucks Owned by Leon County, Fla., Wore Out It Was Replaced with a Caterpillar Diesel. This Truck, Pulling a 12-Foot Blade Grader, Covers About 70 Miles in a 10-Hour Day, Consuming About One Gallon of Diesel Fuel an Hour

New Electric Heater For Asphalt Plants

An electric heater which is new in the United States but which has a background of success in England is now being built by the Easton Car & Construction Co., 10 E. 40th St., New York City. This new heater employs the Clarmac system of electric heating of bituminous materials which is said to result in a saving of from 25 to 50 per cent in heating costs as compared with the steam boiler method because electricity is more readily controlled, and fuel handling costs are eliminated as well as stokers, boiler inspection and insurance.

The Easton-Clarmac electric bitumen heater is a rectangular steel tank equipped with electric heating elements uniformly disposed in the bottom of the tank. The number of heating elements required varies according to the size of the tank. They are controlled by switches permitting as many as are needed to be used under automatic control. A main contactor or magnetic switch actuated by a sensitive thermostat control automatically maintains the desired temperature of the bitumen.

A gear-type pump submerged in the bitumen just above the heating elements is used to move the asphalt and is driven by a vertical reversible motor located on top of the tank. The supply line is so arranged that while the pump operates continuously the bitumen not drawn off is returned immediately to the heater. At the end of the day's run the pump is reversed and the pipe line emptied when the pump is turned off for the night.

The tank or heater should be insulated and set on a small concrete foundation

and housed in an economical building for the protection of the electrical apparatus. The Easton-Clarmac system

is also applicable to existing storage tanks for maintaining the bitumen in them at a pumping temperature. In cases where delivery of the bitumen is made by rail, a small portable steam boiler can be used when necessary for raising the bitumen in the railroad tank cars to the proper pumping temperature.

These bitumen heaters are furnished in any desired capacity but usually are large enough to contain either the average or maximum day's supply of bitumen for the asphalt plant. The 3,000-gallon heater is approximately 7 x 7 x 10 feet.

N. J. Loses Over \$7,000,000

New Jersey will lose more than \$7,000,000 in diverted gas-tax funds plus the penalties to be invoked under Section 12 of the Hayden-Cartwright Act because of the Legislative action in passing the gas-tax diversion bill over Governor Hoffman's veto. In addition

to the loss of highway revenues for highway uses, in the next two years New Jersey stands to lose more than \$3,000,000 of Federal funds under the above-mentioned penalties.

New Jersey is the second state to feel the axe as far as Federal-Aid is concerned, and still has the alternative taken by Maryland of voting to return to highway purposes the money diverted to other uses.

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A TRUE "FISH STORY"

By LOWELL THOMAS

"Talk about strange cargoes. Listen to this true 'fish story.' Out in Martinsville, Ind., is the world's largest goldfish hatchery. The principal market, New York City, is a thousand miles away. To make this jump the Grassyfork Fisheries built a special tank truck, a ten-tire giant that can haul 200,000 fish in one load.

"To protect this precious shipment, the truck is heavily insulated. A special engine drives a compressor, forces a constant stream of air through the 1400 gallons of water.

CAN'T TAKE CHANCES

"Once a week in zero-weather January or broiling July this big truck makes the eastward journey. Carries fish for the East, rare specimens to go aboard Atlantic liners. They must 'bring 'em in alive.' Delays would be costly. You can't take chances on tire failure with a job like this.

"But they tell me they just don't have tire trouble with

Goodrich Triple Protected Silvertowns. Not one sidewall failure! And they run up tremendous mileages.

"In all my travels I've noticed that on the toughest trucking jobs you usually find Goodrich Silvertowns."

Lowell Thomas is right! Where the going is hardest Goodrich is first choice. Goodrich Tires are being tortured in heavy forests under crushing log loads of 15 and 20 tons, through burning deserts on fast schedules at 130° temperatures—over jagged rock in coal mine operations—in the army through ditches and underbrush, on no road at all! And they take this punishment in their stride.



Goodrich Silvertowns are Triple Protected in the sidewall—built with an invention that checks 80% of all premature failures. Only Goodrich gives you this 3-way safeguard:

- 1 PLYFLEX—distributes stresses throughout the tire—prevents ply separation—checks local weakness.
- 2 PLY-LOCK—protects the tire from breaks caused by short plies tearing loose above the bead.

3 100% FULL-FLOATING CORD—eliminates cross cords from all plies—reduces heat in the tire 12%.

On your trucks, too, you can get a new freedom from road delays and big repair bills and at the same time increase mileage with Triple Protected Silvertowns. See the Goodrich dealer and start saving. Or write The B. F. Goodrich Co., Akron, Ohio and Los Angeles, Calif.



Goodrich Triple Protected Silvertowns

SPECIFY THESE NEW SILVERTOWN TIRES FOR TRUCKS AND BUSES

THE STRONGEST GEARED POWER FOR ITS WEIGHT IN THE WORLD

ALL STEEL HAND HOIST

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COMPACT—POWERFUL—SAFE

"For use where power is not practical or available"

Manufactured in 2, 5 and 15-Ton Sizes. For capacity comparison, $\frac{1}{2}$ " cable used:

2-Ton "Lightweight"	75 ft.
5-Ton "General Utility"	250 ft.
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Patent instant gear change and positive internal brake that never fails, and will lock load.

Gear Ratios	Weight	Price
2-Ton 4 & 22 to 1	60 lb.	\$50
5-Ton 4 & 24 to 1	110 lb.	\$75
15-Ton 4, 19 & 109 to 1	640 lb.	\$200

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Asphalt Mastic Binder for Jetty

U. S. Engineer District Experiments at South Jetty of Columbia River Exposed to Heavy Seas

By R. E. HICKSON,
U. S. Engineer, M., Am. Soc. C. E.

JETTIES on the North Pacific Coast are exposed to very heavy seas and, although generally constructed of heavy stone and of large section, are gradually battered down to about low water level or below. In general the plan heretofore has been to allow this deterioration to proceed for a considerable period of years and then reconstruct the superstructure. This method of maintenance is probably the most economical as to cost but for some time before reconstruction is undertaken, the structure has to some extent lost its effectiveness as a breakwater and current controlling device, and in some cases may become a menace to navigation.

There has accordingly been a desire to find a type of construction that would materially extend the useful life of the structures without unduly increasing the cost.

In order to prevent destruction by heavy seas passing over the top, the South Jetty at the Columbia River has been built up to an elevation of 26 feet above low water, but since the heavy seas cross the line of jetty at an abrupt angle deterioration by ravelling at the sea end proceeds at a rapid rate unless some type of terminal structure is provided.

After several plans for a terminal structure had been prepared, it was decided to try binding the enrockment together with an asphalt mastic for a distance of some 300 feet from the sea end to prevent this piece-meal disintegration. Reconstruction of the jetties at Galveston had recently been successfully completed with the use of asphalt, and while the jobs are not comparable as to size or sea conditions it was thought that the use of asphalt should be tried on the Columbia Jetty.

Asphalt Plant

On account of the short season of weather satisfactory for placing asphalt and the uncertainties involved in this first experimental job, it was decided to rent the necessary plant and do the work by hired labor, rather than by contract. An asphalt plant with necessary heating equipment and power was set up on Clatsop Spit adjacent to the jetty and a good supply of sand. The plant consisted of the following: one boiler and 150-hp engine for heating and power; one retort (not used), and one Crescent dragline for supplying sand. The asphalt mixing plant included two oil-

fired driers, 56 inches x 20 feet; two cold sand elevators; one hot sand elevator; one hot sand bin; one 3,000-pound mixer; sand and asphalt scales and other appurtenances.

For transportation and placing material, there were two locomotives; three flat cars with three 10-ton dump buckets on each car; two locomotive cranes and a clamshell bucket. A gasoline speeder and trailer were used for inspection and for handling men.

Trackage was provided to store six cars of asphalt and two cars of fuel oil alongside the heating and power boiler, and additional trackage for switching and handling the output of the mixing plant. The asphalt plant was delivered by rail on July 3, 1936 and erection was started immediately. On August 5 the



Placing Asphaltic Concrete at the Toe of the Slope with a Clamshell Bucket

plant was placed in operation to furnish the asphalt mastic.

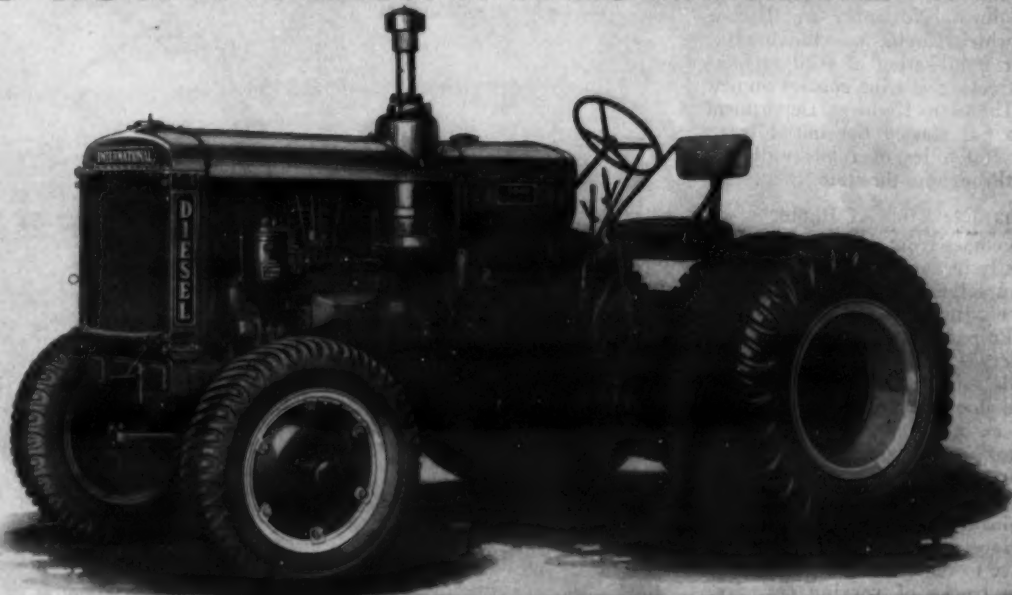
Preparing the Asphalt Mastic

The enrockment of the jetty was already in place, except for building up and dressing the slopes to a cross-section about 26 feet high above low water, 60

feet wide on top and with slopes of 1 1/2 to 1. The job was to impregnate this enrockment with an asphaltic mastic to as great a depth as possible with a view to binding the structure into a mass which would not be unravelled or moved by the sea.

(Continued on page 40)

America's FIRST Diesel-Powered Industrial Wheel Tractor . . . the new INTERNATIONAL ID-40

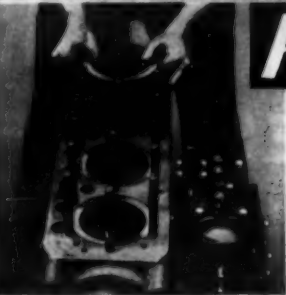


Power, Quality and Economy

● International Harvester, world's largest tractor builder, scores another first with the new Model ID-40. This organization has adapted the Diesel principle to wheel-type industrial tractor operation, the first time this has been done in America. This new tractor uses the same International Diesel engine that has proved so successful in the International TD-40 TracTracTor and the Model PD-40 Power Unit. The Model ID-40 Tractor has power and stamina to handle a variety of heavy-duty work calling for a wheel tractor. Investigate this new addition to the line of International Industrial Power, which includes wheel and crawler tractors, and power units from 12 to more than 100 h. p.



INTERNATIONAL Model I-40
This tractor is also new in the International Industrial Power line. It is similar in design and construction to the Model ID-40 but is powered with the efficient 6-cylinder gasoline engine used in the Model T-40 TracTracTor. Both of these tractors have the well-known features of International manufacture which mean so much to the user in low operating costs and maintenance economy.



Replaceable cylinders—an example of the big money-saving features built into all International Tractors.



The Model ID-40 is as easy to crank as a gasoline tractor of corresponding size.

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For Concrete Pavements

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ONE-MAN PORTABLE VIBRATOR
"THE WOLLOPER"
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Weight 65 lbs., complete

GASOLINE OR ELECTRIC
FLEXIBLE SHAFT VIBRATORS

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Road Stabilization With New Binder

Washington and New Jersey
Carry Out Experiments with
Lignin Binder from Hemlock
Trees

SOME interesting demonstrations have been made of the adaptability of lignin liquor, a by-product of the manufacture of rayon pulp, as a road binder for stabilization. Lignin is the natural cement that binds the fibres of wood together in the tree. Extracted from the hemlock trees of the Pacific Northwest, the lignin liquor is chemically processed, neutralized and concentrated, and may be used for binding and stabilizing loose road materials at exceptionally low cost.

Counties and cities in the State of Washington treated about 300 miles of unpaved streets and roads with Raylig, as this binder is called, from June 1 to December 1, using nearly 1,500,000 gallons for various types of treatment. The State Highway Department of New Jersey, during last July and August, used 601,441 gallons for treating pavement shoulders and surfaces of secondary roads, while another 500,000 gallons was used by counties and towns. Maryland treated seventeen state projects during November and December, in which Raylig was the binding agent for stabilization of road surfaces and for treating wearing courses on new roads. The State Highway Department of Idaho has started the initial treatment of 160 miles of roads well distributed throughout the state.

Characteristics of Binder

Lignin comes from the digester in the mill usually in a concentration of about 8 per cent solids. This solution, under the process now being used by the Rainier Pulp & Paper Co., to produce this binder, is concentrated to a 46 per cent solids solution. As this high concentration does not readily adapt itself to use in an ordinary pressure distributor, approximately equal parts of cold water are added to bring the solution down to about 26 per cent solids, at which point it is ready to apply on the road surface. It is shipped in tank cars of six to ten thousand gallons capacity, in trucks of varying capacity, in scows or in inter-coastal liners.

No heat is required in application of this material and, after application, the road surface can be opened to traffic immediately. The lignin solution, as used thus far, ordinarily penetrates to a depth of one or more inches. The material mixes thoroughly with mineral aggregates, the water evaporates, and the lignin, reacting with the road soils, effects a dense, hard mix which sets up within six to eight hours and seals the surface for ordinary weathering and traffic.

Specifications

Tentative specifications for the use of lignin binder on unpaved road surfaces state that for light dust treatment a lignin application of $\frac{1}{2}$ -gallon of the 26 per cent solution per square yard can be expected to last for one season only and should be renewed each spring.

A heavier lignin treatment, designated as the penetration method, specifies the use of from $\frac{3}{4}$ to 1-gallon of the 26 per cent solution per square yard. This is considered sufficient to penetrate into the road surfacing material an inch or more, to stabilize it, holding the materials in place to eliminate blading, and assumes that a considerable portion of the binder will remain in the roadway surface during rains and that part of its effectiveness, at least, should carry over into the next season.

The third, or build-up, treatment,

calls for the use of 1 to $1\frac{1}{2}$ gallons of the 26 per cent solution per square yard by the usual lift method of spreading an application of the Raylig binder, covering with a $\frac{3}{4}$ to 1-inch layer of the surfacing material which has been windrowed to either side of the roadway, repeating this operation if a thicker mat is required and finishing with a double application of Raylig to the surface.

Preparation of Road Surface

Road surfaces are prepared for dust treatment with Raylig by light blading, to remove coarse gravel and eliminate chuck holes, etc. This material is bladed over to the side of the road and left there. The road is then sprayed under about 25 pounds pressure. This method has proved very effective where desired fines are present in the roadway, as demonstrated by the mileage treated in this manner in Kitsap, King, Lewis, Mason and Yakima Counties, Washington.

Preparation of the roadway for the penetration method of treatment is very

similar to that for dust prevention, except that it is often advantageous to scarify the roadway to a depth of an inch or so to remove ruts, washboards and loose gravel. It is also often necessary to supply the required fines. For example, a supply of clay on a road surface deficient in fines brings a remarkable improvement in the results.

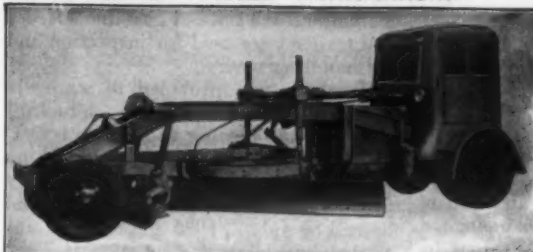
The build-up method requires a similar type of preparation as inverted

penetration with petroleum products. Present methods of application of Raylig call for the use of a tack coat of $\frac{1}{2}$ -gallon of the 26 per cent solution per square yard, followed by an application of $\frac{1}{2}$ -gallon on each lift. A single lift will produce a mat from 2 to $2\frac{1}{2}$ inches in depth. This is followed by a seal coat of $\frac{1}{4}$ -gallon per square yard.

Experience thus far reveals that the

(Continued on page 35)

ROME DESIGN MATERIALS WORKMANSHIP



ROME DESIGN has been copied but never equaled. ROME MATERIALS are selected to conform to definite specifications. ROME WORKMANSHIP is first-class in every detail. DEALERS in principal cities.

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You CAN'T MOVE ROCK WITH PAPER HORSEPOWER...



Waukesha-powered
Marion 2-yd. shovel,
building a road near
Bridgeport, Wisconsin

It takes REAL HORSEPOWER TO DIG LIMESTONE

You can give an engine an impressive performance curve—and put it in a shovel. But if it's only paper horsepower it won't move a yard.

This shovel is digging limestone without the use of drills or dynamite! That takes *real horsepower*—Waukesha horsepower—delivered by an engine built with rugged parts not overstrained by over rating.

The shovel, a Type 381, 2-yd. Marion, is going through 50,000 yards of rock, moving 300,000 yards on a road building job near Bridgeport, Wisconsin, and five wagons and three tractors are being kept busy on a quarter mile haul. The shovel is powered by a 6-cyl., 125-190 hp. EKH Waukesha-Hesselman Oil Engine, burning No. 3 furnace oil.

A low compression, solid injection oil engine, with precisely timed electric ignition, the Waukesha-Hesselman gives easier starting, smoother running and lower up-keep... with low cost, high speed diesel fuels. Write for Bulletin 1011-B.

WAUKESHA MOTOR COMPANY, WAUKESHA, WISCONSIN
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WAUKESHA ENGINES

Sodium Lights Installed To Protect Pedestrians

Work on the installation of General Electric sodium lights on Oregon's first highway safety lighting program on the Portland-Oregon City super-highway is now under way. Twelve dangerous intersections, at which pedestrians have been killed at an alarming rate, according to state police officials, will be lighted by twelve of these units. The lights are being placed in the interest of

safety on the four-lane highway to enable motorists to see pedestrians crossing the wide roadway and thus avoid hitting them.

Greece Starts Program For Public Works and Roads

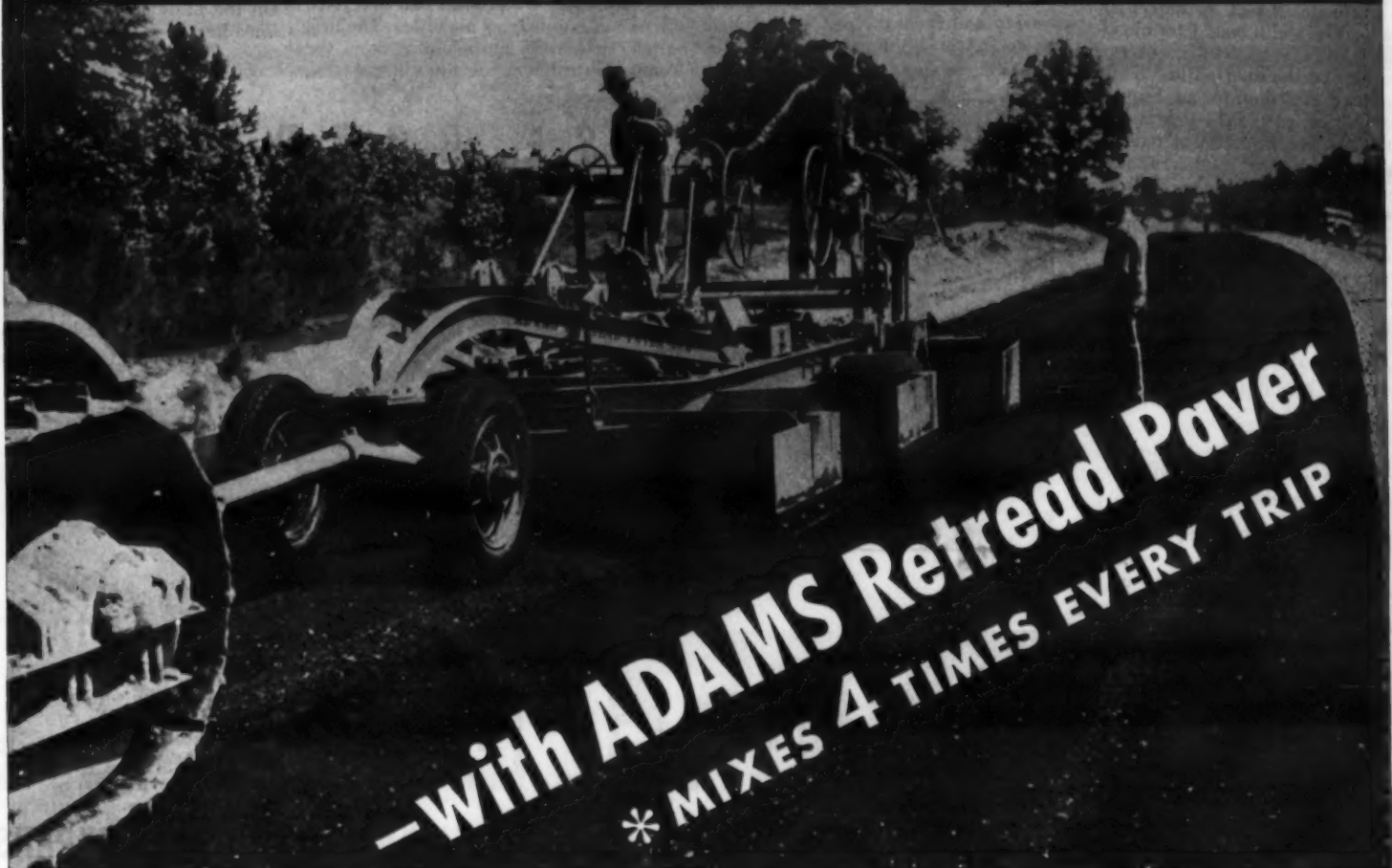
A 10-year program for public works of a productive character, estimated to cost about \$66,000,000, was announced by the Greek Government in March 1937. The work is to be carried out in all parts of Greece and includes the com-

pletion of the highway and railway systems of the country. The program has been divided into two groups, the first including works to be executed with "extraordinary" funds, and the second covering the works to be financed by special appropriations from the Greek budget over a period of ten years. The amount of the allocation for highways, railroads and ports works is 2,328,000,000 drachma or about \$20,592,000, according to a report from the U. S. Bureau of Foreign and Domestic Commerce.

New Gen. Mgr. for Hyatt

Announcement has been made by General Motors Corp. of the appointment of H. O. K. Meister as General Manager of the Hyatt Bearings Division of General Motors in Harrison, N. J., to succeed the late H. J. Forsythe. Mr. Meister has been associated with Hyatt since 1914, having served in several capacities with the Hyatt Roller Bearing Co. and later as General Sales Manager and Assistant General Manager of the Hyatt Bearings Division.

Better, Cheaper Black-Top Roads



● Two things, among others, are very definitely necessary to make a good bituminous "road mix" job—first, a thorough mix and second, a smooth, uniform finish to give the proper riding qualities.

Any blade machine will eventually get the material mixed, but Adams Retread Paver will do it quicker and cheaper because it mixes the material *four times in one trip*. Where quick-setting bitumen is used the quick mixing of Adams Retread Paver is a decided advantage because it accomplishes the mix while the bitumen is in its most liquid state.

As for finishing—in one round trip it lays the material out to proper width, depth and crown, smooth as a floor

and ready for rolling. Edges are straight and clean-cut, requiring no hand work.

Adams Retread Paver takes the place of four motor graders and does the job better and cheaper. Works equally well with stone, slag or gravel—with tar, asphalt or road oil. Also a money-saver for mixing on gravel road stabilization work. Pulled by a tractor of 60 or more drawbar H. P. Ask your local Adams representative or write for complete descriptive catalog to



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Branches, Representatives and Distributors throughout United States

Mixing 3 inches of graded aggregate and cut-back asphalt. Four sets of mixing blades mix the material four times each trip.



Laying out the mixed material to proper width, depth and cross section. Note the straight clean-cut edges being laid to a string line.



Improving Roads With Skin-Mat

(Continued from page 1)

the soil and gravel quite well. A C-3 60-70 asphaltic-type oil was used for this work in 1935.

When the sections were selected last year for resurfacing with road-mix, the maintenance crews were sent out to pull in sandy top soil from the ditches with the power graders and to haul in sand where needed to give the proper soil for mixing with the graders. When this was completed for any section to be treated, the material was windrowed in the center of the road to be sure that it was of uniform consistency and composition.

The next step was to spread the windrow to a width of 12 feet in the center of the road. The width was determined by the width of the spreader bars carrying the nozzles on the distributor. This county has two distributors, an Etnyre 800-gallon unit on an FWD truck and a Rosco 1,000-gallon unit on a Gotfredson truck. A tank car was spotted at the railroad siding nearest to the section being treated and the road oil hauled by the distributors. In the case under discussion the dead haul was about 9 miles to the nearest siding available.

The material was shot with about 0.75-gallon of SC-5 60-70 asphaltic-type oil per square yard and then mixed with four power graders with 12-foot blades. A considerable amount of SC-6 asphaltic-type material is also being used for this same type of work. There were a Caterpillar and an Allis-Chalmers grader with power operation of the blades and two Adams graders with hand operated blades. At times two other graders were used with these four to hasten the work. On the first trip after a shot of oil the first grader cut the material from the left toward the center, the second cut it from the right and then the two remaining started the mixing operation. Thus on the very first trip over the road, it was again open on both sides for traffic. This is an important point as the traffic is never detoured for this work and the local traffic is always able to reach its destination along the road without getting covered with oil. Further the graders are kept as close together as possible in order to delay traffic in passing them as little as possible.

The crews work the road in sections about $\frac{3}{4}$ -mile in length, but the distance may be varied by the opportunity for turning the graders, the location of important highways crossing the work and many other factors. On this section



C. & E. M. Photo

Applying SC-5 Followed by Immediate Mixing by Four Power Graders on Gravel Road Maintenance by the "Skin-Mat" Method

they were able to complete about 2 miles of highway a day.

This same crew, using a Baker disc ahead on old oiled surface, completed 12.85 miles in four days, including moves to and from the railroad sidings. The amount of bitumen used on this 12.85-mile section was approximately

3,000 gallons per mile, while the section described used about 7,000 gallons per mile.

Mixing

The mixing is a process that is carried on as continuously as possible. The first grader windrows the material from the center toward the side, then the second

grader takes the windrow out to the edge of the surface over which the material eventually is to be spread. The third and fourth graders then pull the material back in two windrows. In this manner on each trip that the four graders make over the road the material with the oil is spread over the half width of the road and the oil has a chance to get onto the base, which is essential if the completed mix is to stick to the base when finally spread. This also cleans the base of any loose material. A minimum of two round trips of the four graders is required to mix the materials thoroughly after the first application of oil. If the material from the road is a blow sand many more than two round trips are required.

For the second application of oil the mixed material is spread to a width of 6 feet and from 0.5 to 0.75-gallon of the same oil is shot with the distributors. On the blow sand as much as $1\frac{3}{4}$ gallons has been applied for the second mix. Two more round trips of the fleet

(Continued on page 36)

UNDER THESE ROADS . . .



PROTECTION!

AGAINST THE POWERFUL FORCES OF CONTRACTION AND EXPANSION

Today . . . no concrete pavement can be called "modern" if it lacks adequate reinforcement against the destructive forces of contraction and expansion, heavy traffic and the greatest possible provision for imperfect subgrade conditions. • Years of development of Truscon Steel Reinforcing Products for concrete pavements have made these engineered products essential to present-day construction requirements. • Truscon Expansion Joints and Contraction Plates provide necessary protection against sudden

and extreme variations in temperature, infiltration of inert material, efficient transfer of loads, an effective water-tight seal at the surface, and other vital advantages. • The complete Truscon line includes every steel reinforcing product required for proper construction of concrete roads. Our engineers will cooperate to the fullest extent. Write for catalog and complete explanation.

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The special alloy steel in the Williams "DXL" Dragline Bucket enables a lighter yet stronger construction. The result—freer handling and a saving of crane time.

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POWER ARM, POWER WHEEL, MULTIPLE-ROPE,
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VOLUME PUMP

FOR TRACK ROLLS . . .

CUTS UPKEEP EXPENSE

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- ★ EXTRA CAPACITY
- ★ PATENTED PRESSURE RELEASE
- ★ HANDY FOOT LEVER
- ★ DOUBLE ACTION PUMP

THIS new double efficiency Alemite Volume Pump develops 3000 pounds pressure per square inch. It holds 35 pounds of lubricant. Patented pressure release *saves wear and tear* on the hose. And the pump delivers lubricant on *both up and down* strokes — one pound of lubricant to every 20 complete strokes.

This Alemite Volume Pump has already been adopted as *standard equipment* by all leading manufacturers of crawler-type tractors for track roll lubrication. It forces lubricant to all bearing surfaces — cuts upkeep expense — makes bearings last longer!

Use the new Alemite Volume Pump to give

the track roll bearings of your machines the kind of lubrication the manufacturers *intended* them to have!

You will find complete information on all types of Alemite Guns and Lubrication Equipment in our new FREE manual, "Alemite Controlled Lubrication." Mail the coupon for your copy now!

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Stewart-Warner-Alemite Corp'n. of Canada, Ltd., Belleville, Ontario

Enjoy Horace Heidt and his Alemite Brigadiers every Monday evening, over Columbia Coast-to-Coast Network. See local papers for time of broadcast.

• See how easily this great new Alemite Volume Pump grips the Alemite Giant Button Head Fitting, cleaning off all dirt and forming a leakproof seal.



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WORLD'S LARGEST MANUFACTURERS OF
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Please send my FREE copy of your new manual, "Alemite Controlled Lubrication."

Name _____

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Ill. Paving Job Affected by Heat

(Continued from page 2)

be taken care of more readily by the rotary scraper was entrusted to an Adams No. 8 pullgrader.

The contractor's R-B Finegrader riding on the forms cut the grade to within $\frac{1}{4}$ -inch of the final contour, leaving it flat for the Fordson tractor with loaded wheels to roll the grade smooth. The final checking was done with a heavy Koehring trail-grader taken from a paver and pulled by a Caterpillar Sixty gas tractor.

After the Finegrader and other equipment had been over the forms they were lined up for the finishing machine by two men who also hand tamped every foot of forms that had to be disturbed to get them back into a true line. Just ahead of the paver and the steel and joint setters, three men pulled the I-beam and bolt scratch template over the forms and trimmed along the forms where the Finegrader had left a windrow of dirt. The pavement was a thickened edge slab 9 inches thick at the edge, then reducing to the center thickness of $6\frac{1}{2}$ inches in the next 2 feet.

Center Steel and Joints

As the paver ran on the shoulder the grade was left clear for the setting of the center steel and the contraction and expansion joints. One man with a wood gage set the center steel, consisting of a plate with a V horizontally in the center so that the 6-inch sheet was $\frac{1}{2}$ inch from the top of the slab. Dowels were set through the center steel at 30-inch intervals. These were 30 inches long, $\frac{1}{2}$ -inch diameter and were round deformed bars supported by metal chairs.

The Ace contraction and expansion joints were set with 30 feet between the joints and the expansion joints at 90-foot intervals. The air space allowed for expansion was 1 inch and the end of each expansion joint was capped with premoulded expansion joint material to prevent the leakage of concrete, grout or dirt into the space, thus destroying the function of the air space. A premoulded strip of material was also set on top of the copper sealing strip at the top of the joint. Two men took care of the setting of the joints. They used a wooden right angle to insure the joints being set true across the slab. One man devoted his time to greasing the forms ahead and to applying the grease to the ends of alternate dowels on the contraction joints. The alternate ends of the dowels on the expansion joints were encased in a metal sleeve with a crimped stop 3 inches from the end to prevent the men from ramming the dowel to the end. The end of the sleeve, which fitted the dowels tight, was also crimped to keep grout from blocking the dowel in its movement into the sleeve when expansion takes place.

Batching

The batching plant for this 5.63-mile project was set up close to the middle of



C. & E. M. Photo

Raising the Front Screed of the Finishing Machine to Clear a Transverse Expansion Joint

the job and the paving started at the Benson end and continued toward the plant. Then the paver was shifted to the Roanoke end and the paving continued back again to the plant.

Both aggregates were brought in by rail and unloaded direct from the gondola cars to the bins with ample provi-

sion for stockpiles in case of delays in shipments. The gravel came from the Chicago Gravel Co. plant at Rockdale, Ill., and the sand from the McGrath Sand & Gravel Co. plant at Chillicothe, Ill. A Koehring crane with a 1-yard clamshell handled all the aggregate to the bins over the Johnson weighing

batches. The batches were delivered to the batch trucks with 1,405 pounds of sand, 2,313 pounds of gravel and then 578.33 pounds of cement were added at the bulk cement handling platforms.

Each of the local trucks hired for hauling batches was equipped with a pair of wood or galvanized iron covers so that the batches and cement were completely covered when hauling from the cement platform to the paver. The cement was delivered to a siding near the batching plant and, as far as possible, the contractor worked one car at a time. Five men took turns shoveling to and wheeling the four Johnson Kone-Karts to the Kartweigh scales. A pair of slots in the dumping platform permitted the cement handlers to dump the batches into the trucks accurately when the drivers spotted them correctly. The batch trucks were all 2-batch machines hired locally and the fleet varied from five to twelve trucks, according to the length of the haul.

(Continued on page 31)

27 TONS
at
29' RADIUS

All in a day's work on the Metropolitan Aqueduct, Los Angeles, California.

Read what the United Concrete Pipe Corporation of Los Angeles says about their LIMA crane.

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SHOVEL and CRANE DIVISION
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No Silos Required

LARGE CAPACITY PORTABLE PLANTS WITH 1-TON, 1½-TON OR 2-TON MIXER

Electrical or Mechanical Time Lock to Meet Any State Specifications

The F. D. Cumer & Son Co.

17th and Euclid CLEVELAND, OHIO



The New Stephens-Adamson Impact Belt Carrier

New Impact Belt Carrier With Solid Rubber Rolls

The necessity of building a completely new type of carrier for the large installation of the Inland Lime & Stone Co. plant at Port Inland, Mich., to withstand the impact of large lumps of conveyed limestone, led the Stephens-Adamson Mfg. Co., of Aurora, Ill., to develop and market its impact belt carrier. The features of this new carrier are its long life under consistently heavy impact, and the additional life span it adds to belts because of its cushioning effect, according to the manufacturer.

These features are the result of the 17/8-inch vulcanized rubber covering extending around the 2 1/4-inch hub, giving a roller of standard 6-inch diameter. The rubber is wound about the pressed steel hub in layers, the first layer vulcanized to the steel hub, and additional layers vulcanized to give the 17/8-inch solid rubber cushion. The carrier is built in two different styles, one for normal and one for heavy duty. It is tilted to train the belt without guide rollers. There are three 6-inch rollers with the outer rollers tilted to give a 20-degree trough. The impact carrier can also be furnished for flat belts. Each roller turns on two Timken tapered roller bearings with positive adjustment for bearing clearance. Seals protect the bearings from dirt and each bearing has individual pressure-lubrication fittings.

The S-A impact carrier is particularly adapted for use under heavy loading points, in belt feeders and under the entire length of movable shuttle conveyors where conveyed material is received.

Selective Lubrication

An interesting and instructive article on the value of selective lubrication for construction equipment appeared in the April, 1937, issue of "Lubrication," published by the Texas Co., 135 E. 42nd St., New York City. The lubricating problems of power plants, air compressors, steam cylinders, electric motors, gears, chains and wire rope are discussed, as well as the points of lubrication, types of lubricants and their suitability for meeting the needs of these various types of equipment.

Copies of this issue of "Lubrication"

Complete CONCRETE Curing

New Haven Cotton Road Mats are approved by the Federal Bureau of Roads

Curing costs with mats are as low as 1 1/2 cents a square yard

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ADVANCED CONCRETE ROAD CURING CO.
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are still available by writing to the Texas Co. at the above address and mentioning **CONTRACTORS AND ENGINEERS MONTHLY**.

Improvements Announced For Pressure Distributors

New improvements for the new Littleford Model C bituminous distributor have been announced by Littleford Bros., Inc., 485 E. Pearl St., Cincinnati, Ohio. The Littleford distributor was the first to introduce the idea of instant cut-off at the spray bars by applying the full force of the suction side of the material pump on the lines, sucking the bitumen in the lines back into the tank by means of the patented Littleford single valve.

The 1937 Model C adds to this principle by the use of special suction fittings on the manifold bar and spray bars that prevent the entrance of air through nozzles from breaking the suction until the lines are emptied, thus



The 1937 Littleford Model C Pressure Distributor

eliminating the bothersome dribble of bituminous material from the bars after cutting off the spray.

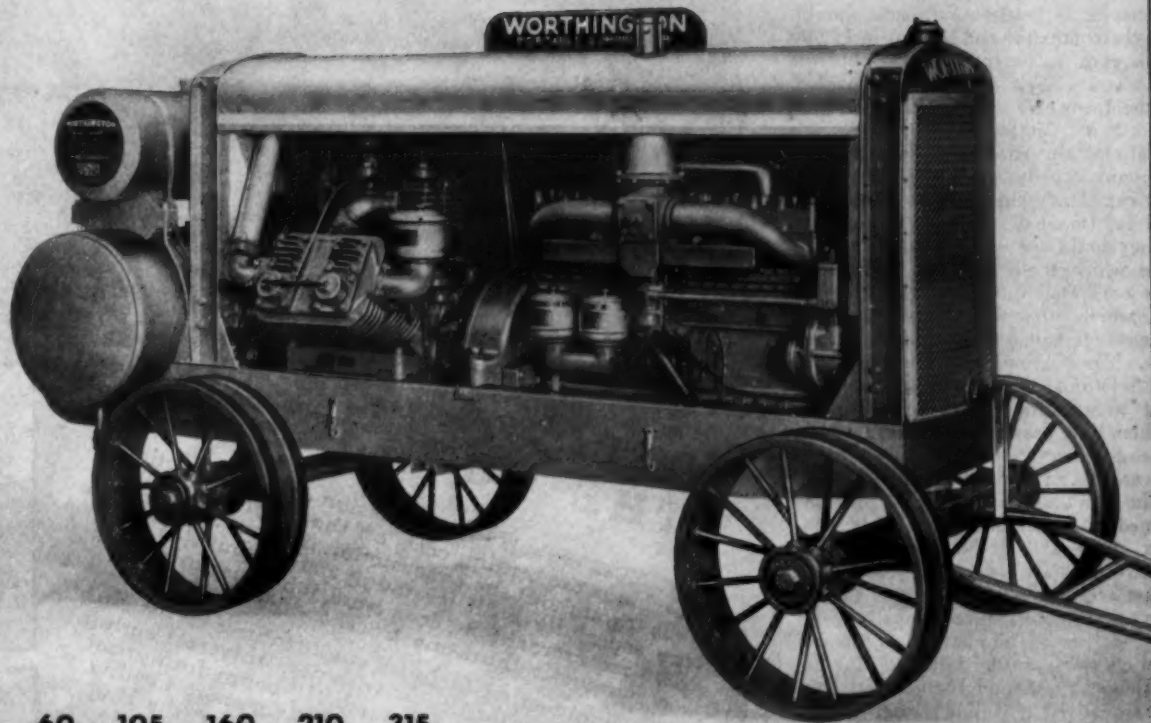
Other new features on this Model C include a specially designed hood over the spray bars that shields the operator and pumping engine from dust, fumes and fog. Streamlined rear wheel fenders protect the operator and machine from bitumen, dust and chips thrown by the tires. The spray bar raises to give ample

road clearance between shots. This also helps when applying a "fog" shot. Dust caps seal the spray bar feed lines against dust and stones while the spray bars are removed. A signal system between operator and driver utilizes the truck horn with push button control at both ends. The Littleford low-pressure burner and continuous heat flue has been improved by the use of a special alloy casting for the combustion tube and flue liner.

In addition to these new features, the basic characteristics of the Littleford Model C, the single valve, crosswise mounting of the pumping engine to cut down overhang, the use of rock wool for insulation, the heat chamber for quick thawing of the pump, valve and lines, the 16 x 4 pneumatic-tired fifth wheel tachometer drive and pump tachometer, have had minor changes for the operator's convenience.

A new bulletin, just released, describes this new distributor in detail, copies of which may be secured direct from the manufacturer..

For CONTINUOUS, DEPENDABLE MONEY-MAKING SERVICE...



60...105...160...210...315

cubic feet

ACTUAL AIR DELIVERED

EVERY TYPE OF MOUNTING

ASK FOR A DEMONSTRATION...There's a Worthington Dealer near you

WORTHINGTON PUMP AND MACHINERY CORPORATION

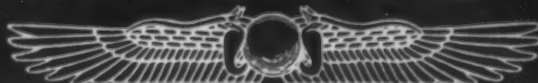
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WASHINGTON

Widening and Preparing Old Concrete for Repaving

Ohio FAP 394-D Completed By One of State's Oldest Contracting Organizations, W. H. Ringwald & Sons

JUST north of Chillicothe, Ohio, U. S. 23, the direct route north through Circleville to Columbus, was widened last summer from 16 feet to 20 feet and resurfaced with brick. The 1.362 miles of concrete pavement was badly broken so an asphaltic leveling course was applied before resurfacing began. Then a new concrete base was laid for the full 20-foot width and topped with brick.

Preparing for Widening

On May 6, 1936, the contractor started work on FAP 394-D by coring out the old shoulder material at the sides of the old 16-foot concrete pavement to provide for the 2-foot widening strips. This top soil was bladed out with a Galion power grader and moved to the sides to be saved for topping the new 8-foot shoulders which border the new widened highway.

In order to bring the old drainage ditches up to grade for the new shoulders, the contractor had to haul in 12,000 cubic yards of borrow. A novel borrow pit was available alongside the project in the form of a 15-foot fill of the defunct Scioto Valley Traction Co. which paralleled the roadway. This traction company in its boom days ran fast third-rail cars from Chillicothe to Columbus and its founders would be astonished if they could know that the embankment over which their fast cars traveled is now converted into fill for a highway over which automobiles travel at a speed at least equivalent to the old interurban cars. The traction line was carried over the Scioto River on a trestle and the bents were continued into the fill. Many of them have been encountered in a good state of preservation in the embankment, as was also an iron crowbar.

The embankment borrow pit was opened at the southern end of the contract and a P & H 300 gas shovel of 1½-yard capacity was put in, loading to a fleet of six 1½-ton Dodge, Ford and Chevrolet trucks, hired locally with owner-drivers. The material, a top soil good enough for use as dressing for the shoulders, was dumped from the trucks and spread by a Galion power grader in 8-inch lifts and then rolled with a 10-ton Galion gas roller.

Leveling Course for Old Slab

Because of the condition of the old concrete slab the state decided to use a bituminous treatment so there would not be a bond between the old slab and the new concrete base. Tar was purchased from the Southern Ohio Quarries and applied by their distributor at the rate of 0.05-gallon per square foot. This was immediately covered with 2¼ pounds of No. 6 stone, ½-inch and smaller in size, using a chip spreader for uniform distribution. The stone was also furnished by the Southern Ohio Quarries. The stone was left to set and bonded well with the old concrete, bringing up the low places and leaving a level course to keep the new concrete from bonding with the old.

Concrete Base and Widening Strips

The contractor set the 9-inch Heltzel

steel forms, with 10-inch base, just 2 feet from the edge of the old pavement to widen it and give an edge thickness of 9 inches. The new concrete base over the old concrete varied from 4½ to 6 inches in thickness because of changes in the new grade. At the edge of the widening strips, curbs 3½ inches high and 9 inches wide were built with the use of curb forms on the steel road forms to provide for the thickness of the brick and bedding course.

A carefully adjusted finger template was made by the contractor to ride the forms as a means of accurately determining the grade which was specified at

9 inches at the outside and 8½ inches at the edge of the old concrete.

The contractor used the batching plant at the sand and gravel pit of Brewer & Brewer about 6 miles south of Chillicothe, giving 7 miles dead haul to the job. The batches were hauled in a fleet of 8-batch trucks hired locally. The batches were mixed by a MultiFoote paver running on the bituminous level-

ing course on the old slab. The base course was brought to grade with a Lake-wood finisher running on the forms.

Contraction joints were impressed in the new concrete base course every 25 feet by a Flex-Plane machine and a continuous longitudinal center joint was similarly installed. These were later poured. The base course was reinforced

(Continued on page 48)

"DO YOU KNOW?"

The wide screed finishing machine is winning laurels everywhere. It produces an unbelievably smooth surface. Back screeding is only one of its features. Don't forget our contraction joint equipment.

Flexible Road Joint Machine Company
WARREN, OHIO





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THE TOUGHEST JOBS

BECAUSE of their superior design and construction, Hugs are cutting costs on the toughest hauling jobs throughout the construction industry. For Hugs are especially built for tough going—built to your own requirements to do a hard job faster and more economically than any truck on the market.

Hug engineering includes such features as the Hug front axle rocker action with new universal spring shackle; rugged arc welded "I" beam frame; set back wheel design with resulting short turning radius and equalized load distribution; the Hug back-up brake that makes the long back-up easy; double reduction rear axle; wide range of transmission speeds; heavy duty spring design and a range of arc welded bodies to meet any hauling requirement.

Hugs are available for every type of dump truck transportation service—for batch hauling, quarry operations, for dirt and rock excavation—and with Hugs you'll get faster hauling of bigger pay loads at less cost.

Write to Hug today! Let Hug engineers show you how Hug transportation units can meet your toughest hauling problems and cut your hauling costs.

COSTS ON EVERYWHERE

Model 99 Hug Quarry Special. Designed for heavy duty quarry service, with 10-yard Hug Quarry body—36,000 lbs. pay load capacity.



Model 23D Hug Roadbuilder. 3 to 3½ yard capacity especially designed for multiple batch hauling.



Model 87Q Hug Roadbuilder. With standard 6-yard Hug Scoop-End body, U-shaped "I" beam side braces and equipped with high dumping angle power hoist. For dirt and rock excavation work.





THE HUG COMPANY
514 Cypress Street
HIGHLAND, ILLINOIS

Methods and Equipment For Jetting Fills in Mo.

(Continued from page 2)

hydraulic jetting machine that does the work faster and completes the line of holes across an entire fill at one time. This machine invented by Roy Blackwell consists of five jetting pipes, with an extension for a sixth, spaced 5 feet apart, and mounted on a frame for rapid movement. Four sets of dual pneumatics carry the machine. These

can be swung so that the machine may be hauled over the road longitudinally at a rapid speed or when the machine is put into action they are swung so that the machine runs transversely along the fill. When in operation the machine is pulled along by a cable attached to a suitable deadman ahead and operated by a winch and LeRoi engine controlled by the operator of the machine.

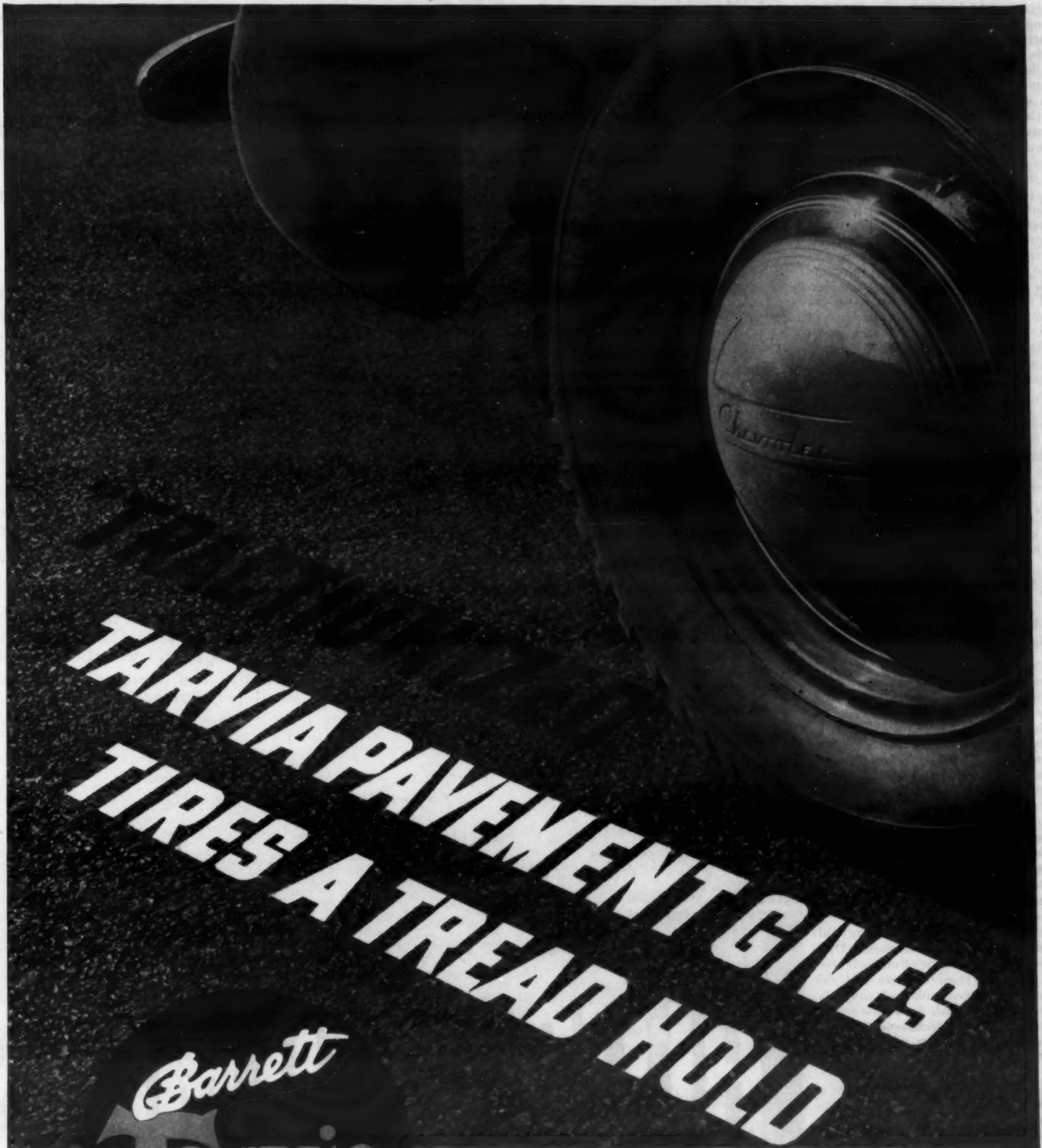
The jetting pipes are mounted inside 6-inch hydraulic cylinders which force the pipes into the ground more rapidly than possible by hand and thus greatly

increase the speed of jetting the fills. A battery of valves at the operator's position controls the amount of water delivered to the jets, the rate of forcing the jetting pipes into the ground and when necessary their lifting from the ground. The machine is made so that successive pipes can be added and the deepest fills jetted quickly and easily. The pipes used for jetting are 1 3/4 inches outside diameter, 3/4 inch inside diameter and the holes at the end vary from 5/16 inch to 7/32 inch, depending on the force to be developed for rapid pene-

tration of the layers of earth. Only fills over 2 feet in depth are jetted.

Abeles Joins Easton Firm

The Easton Car & Construction Co., of Easton, Penna., has announced the appointment of Charles Abeles to its sales organization. Mr. Abeles, who was formerly Assistant Sales Manager in charge of the Eastern District for Koppel Industrial Car & Equipment Co., will make his headquarters in Easton's New York office at 10 E. 40th Street.



**TARVIA PAVEMENT GIVES
TIRES A TREAD HOLD**



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Control of Erosion Along TVA Highways

Report of Snyder and Davis to
Highway Research Board
Describes Methods

(Photo on page 56)

BEFORE the Tennessee Valley Authority embarked on a valley-wide program of highway erosion control, it set up experimental work on highways constructed by TVA to replace existing roads covered by waters impounded by the flood control dams. These experiments were made by the Forestry Division with the aid of CCC labor in the Norris Lake area. It was recognized at the start that much of the erosion in the valley was directly attributable to highways—both newly constructed roads and those of longer standing.

Experimental work was first started in July, 1935. Representative sections of both primary and secondary newly constructed roads were selected as experimental areas, and observations were made from time to time on planting work which had been done on the Norris Freeway under the direction of the Land Planning and Housing Division of TVA. These were reported in a paper by John E. Snyder, Associate Erosion Engineer, Watershed Protection Section, Forestry Division of TVA, and his associate, C. C. Davis at the Sixteenth Annual Meeting of the Highway Research Board of the National Research Council last November.

The experiments covered sections of roads through a cherty limestone clay formation with occasional areas of a mud shale. The secondary roads have a cut slope designed as 1 on 1 but actually constructed steeper in many cases, and have a fill slope of 1 on 1½. The only variant from this practice on the primary roads is that cuts under 6 feet were flattened to a 1 on 3 slope. In a very few cases where right-of-way was sufficient and borrow material was needed, deeper cuts were sloped to 1 on 3.

Reducing Erosion

One basic principle of the experiments is to prevent storm water from highway drainage structures and side ditches from causing any additional erosive action on adjoining lands. This principle was followed on all sections of roads where control work was done.

Care was taken when the roads were built to locate drainage structures in such a manner as to cause a minimum of erosive action before storm drainage reached the culvert and after it was released. Due to the topography of the country, in many cases the best location was none too good and supplementary control measures were required.

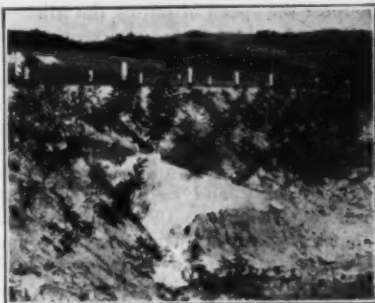
The means of accomplishing this varied with the individual case. Drop inlets at the upper ends of culverts were used. Outlets from culverts and side ditches were paved with rock masonry, loose rock, or brush to a non-erosive grade or surface, the technique employed varying with the volume and velocity of water expected. In some places dams were used in place of paving.

In side ditches a maximum grade of 4 per cent without supplementary control was arbitrarily established and later observation has shown that in the average case this figure is substantially sound. However, the type of soil and volume of run-off are the final determining factors in establishing this maximum grade.

Ditch Control

Three methods of ditch control were used: brush paving, rock paving and masonry checks.

Brush paving was used where a maximum run-off of 5 cubic feet per second



Black Locust in Its Second Growing Season on a Fill Slope of 1 on 1½ on Highway 33 in Claiborne County, Tenn.

was expected or where the ultimate aim was vegetative control. It consisted of a 1½ to 2-inch layer of brush wired

down tightly over a 1-inch layer of straw to conform to the ditch cross-section.

Masonry ditch checks and loose rock paving were used where a run-off of more than 5 cfs was expected. The ditch checks were built of rock and mortar 12 to 18 inches deep and 8 to 10 inches wide, with the surface flush and conforming to the cross-section of the ditch. These checks were spaced so that the bottom of one check was 1 to 2 inches higher than the elevation of the top of the next check down the ditch. In localities where rock is not easily accessible, concrete ditch checks were used.

Rock paving consisted of a 6-inch layer of large flat rock placed and tamped on a bed of straw so that the surface of the paving conformed to the cross-section of the ditch. This loose

rock was at times reinforced by binding 1-foot sections with mortar at intervals of 10 to 20 feet.

Outfall Drainage

Having been adapted from a fairly well-established technique on abandoned farm land, erosion control measures used on outfall drainage have been quite satisfactory. Side ditch control has led to a difference of opinion as to the relative merits of ditch checks as compared to paving. Both methods of control give satisfactory results so far as the prevention of gullying in side ditches is concerned. Labor required for the two methods is approximately equal but less material is needed for ditch checks.

When berm ditches were used to pro-

(Continued on page 45)

ON CHICAGO'S \$328,000,000 SE

Allis-Chalmers

When completed, the four mammoth sewage disposal plants of the Chicago Sanitary District will handle sewage for the equivalent of 6,265,000 persons. Recent improvements scheduled will cost \$200,000,000, bringing the total to \$328,000,000. The \$30,000,000 Southwest works alone (shown here) includes 38 acres of aeration and final settling tanks ... can carry a peak load of 600 million gallons daily ... will be the largest activated sludge plant in the world — and is being erected at the record low cost of \$32,000 per million-gallon capacity.

As on so many other jobs where reliable performance, big output and low costs are absolutely essential ... contractors on the Sanitary District project have chosen Allis-Chalmers Tractors. T. M. White Company first purchased five wide tread "WK's" and a Model "L" ... then two more "L's" and another "K." Herlihy Mid-Continent Co. put four Model "L's" on the job. Hendriks Construction Co. selected a Model "L-O" and 10-yard Continental Scraper. Impressed by the outstanding performance of these A-C units, E. J. Albrecht Co. selected a Model "L" with 10-yard Continental Scraper and a Model "K" with Baker Bulldozer. You, too, can depend on "cheaper-per-yard" performance from Allis-Chalmers tractors. Let the A-C dealer show you.



ALLIS-CHALMERS

TRACTOR DIVISION—MILWAUKEE, U. S. A.

Controlled Ignition OIL TRACTORS

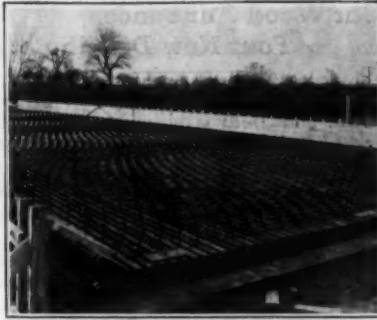
Fidelity & Deposit Co. Offers Washington Service

A folder outlining the services which the Washington, D. C., office of the Fidelity & Deposit Co. of Maryland is prepared to render business organizations in the contracting, engineering and distributor field, has recently been published by that company. One of the eighteen specific services offered is the issuance of bulletins containing advertisements for bids on government construction work, the dates of openings and description of the work, and the names of prospective bidders. Representatives of the F & D office will also attend specified bid openings and mail abstracts to those interested.

Copies of this folder and complete information on this service may be secured direct from the Washington Service Office of the Fidelity & Deposit Co. of Maryland, 210 Albee Bldg., Washington, D. C.

Westinghouse Appoints Mahan General Adv. Mgr.

S. D. Mahan has been appointed General Advertising Manager of the Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa. Formerly manager of merchandising advertising, Mr. Mahan in his new position will have general supervision over all advertising and sales promotion work of Westinghouse and its subsidiary companies. His head-



Close-Up Showing the Shear Developers and Uplift Spikes in Place

quarters will be in Mansfield, Ohio where the merchandising division of the company is located.

Timber and Concrete Bridge in Delaware

New Composite Laminated Timber-Concrete Structure Replaces Obsolete Truss Bridge Near Smyrna

STATE Route No. 6, passing in an east and west direction through Smyrna, Delaware, a town about 11 miles north of Dover, and ending at Woodland Beach, crosses Mill Creek about 1½ miles to the east of Smyrna. An inadequate and obsolete truss bridge with a 13-foot roadway, formerly at this location, has been replaced with a modern structure of the composite laminated timber-concrete type.

The contract for the construction of the new bridge, awarded to Spear & Jones of Dover, Delaware, included the removal of the ancient structure and its stone abutments and also repaving of 20 feet of approaches on either end to the full bridge roadway width of 24 feet. The total length of the project is 200 feet, of which half is the bridge itself. The value of the entire contract was \$6,100, about \$5,300 of which was chargeable to the new bridge.

Plan of Bridge

The plan of the bridge follows very closely a design by the U.S. Bureau of Public Roads for a 1,300-foot structure across the South Branch of the Savannah River near Savannah, Ga., a project under construction at the present time. The 100-foot Mill Creek Bridge, designed for 15-ton loading, consists of five 20-foot spans supported on creosoted timber pile bents. The interior bents have five piles. Two additional piles were driven in the end bents to support the ends of the back walls, which have a length of about 34 feet and a height of 5 feet. Directly back of the backing plank, 3-inch timber sheet piling was driven to a depth of 10 feet. The sheet piles were untreated, since their tops will be perpetually submerged.

The composite laminated timber-concrete type of deck consists of a timber slab, full roadway width, built up of 2-inch dressed plank running longitudinally and covered with a concrete wearing surface, which is effectively connected to the lower or timber portion of the slab by means of small steel plates known as shear developers. These are usually isosceles triangles, with 3¾-inch sides, stamped from 3/32-inch plate. Their function is to prevent any tendency to slip between the two materials along the plane of junction and develop horizontal shearing stresses which enable the concrete wearing surface to be utilized as an integral part of the timber beams or slab. The concrete top provides a satisfactory wearing surface, which protects the timber from abrasion and forms a part of the supporting medium, materially increasing the strength and rigidity of the construction. Its stiffness is also effective in distributing concentrated loads over wide areas of the wood base.

Superstructure

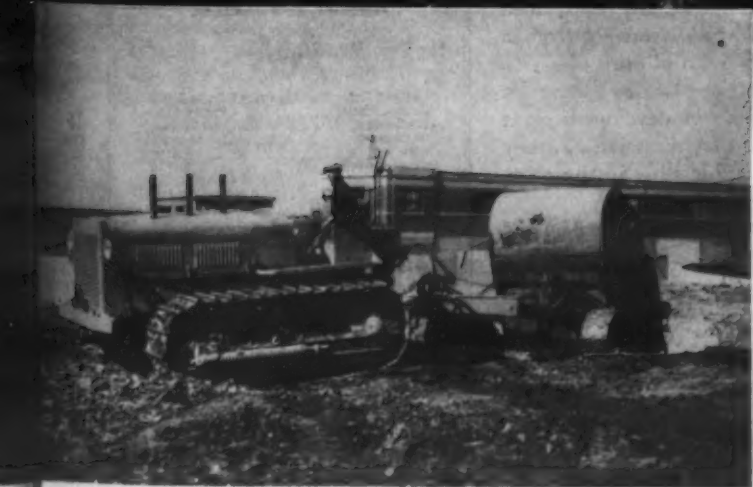
The superstructure of the Mill Creek Bridge consists of staggered 2 x 8-inch creosoted pieces, laid up tight, in a longitudinal direction. The depth of stagger is 1¾ inches, and blocks of that thickness are laid on the caps to provide bearing for the raised timbers. Practically all 2 x 8-inch pieces are full-span length, one out of every three pieces being spliced over a cap, another at one-quarter-span point and the third at the other quarter-span point.

After the deck lumber was in place, the shear developers were installed, followed by driving of the "uplift" spikes.

(Continued on page 41)

SEWAGE CONTROL PROJECT

Owners REPEAT!



CONTRACTORS "REPEAT" ON A-C TRACTORS

Once an Allis-Chalmers Tractor demonstrates its fast-stepping performance on a job, more are bound to follow. That's what happened on the Chicago Sanitary District project. Left to right are jobs of Herlihy Mid-Continent Co., T. M. White Co., E. J. Albrecht Co. (above) and Hendriks Construction Co. A-C owners "repeat."



The New Adnun Finish Spreader

Spreader for All Types Of Road Stone and Gravel

The Adnun Finish Spreader, recently announced by the Foote Co., of Nunda, N. Y., is designed to handle and spread all types of road stone, slag, gravel and cinders. Fastened to the back of the truck, it is claimed to eliminate the need of a grader and to avoid waste of materials and over-run.

Simplicity of design and few moving parts assure low operating and maintenance costs. Accuracy is secured by long guide rails which span the small irregularities that may be present in the subgrade. This Finish Spreader will shape any crown or bank, and the crown or bank contour can be changed while in motion. The spreading width is variable and easily adjusted up to 11 feet and material can be laid right to the curb.

Study of Highway Safety

A comprehensive program of research into the causes of highway accidents is now under way, according to a report to Congress by the Secretary of Agriculture on work being done under an authorization of \$75,000 for safety studies made at the last session of Congress. The U. S. Bureau of Public Roads, which is carrying on the survey, is cooperating with nationally recognized agencies in the field of highway safety in attacking the problem on numerous fronts.

Particular attention is being given to three phases of the highway safety problem: 1, the lack of uniformity in state motor-vehicle laws, which is regarded as an important contributing cause to highway accidents; 2, the characteristics and habits of drivers and the identification of dangerous drivers; and 3, the improvement of basic data, needed for the study of accident causes and prevention. Particular attention is being given to accident reporting.

The Bureau reports that the accident expectancy of the average driver is one accident in about 25 years. Therefore, drivers who have accidents more frequently should be detected and watched. One step in this direction will be the collection and study of accident records of 25,000 drivers over the past six years. Physical and psychological tests of drivers are to be made to measure skills assumed to be essential to safe driving, from which it may be possible to develop methods that will positively identify safe and unsafe drivers to be used by authorities in issuing, suspending and revoking driver permits.

The Secretary's report says that adoption by all states of a Uniform Motor Vehicle Code of five acts, formulated by the National Conference on Street and Highway Safety and recommended for adoption by all states, would be an important step in promoting highway safety as well as facilitating movement of highway traffic.

Traffic accidents and fatalities have reached proportions that place them in the front rank of critical national problems. They involve not one but a whole series of causes and conditions which, to be remedied, must first be understood. The ultimate solution of the problems involved will call for the best efforts and cooperation of all drivers as well as local, state and national authorities.

Gar Wood Announces Four New Distributors

Announcement has been made by the Hoist and Body Division, Gar Wood Industries, Inc., Detroit, Mich., of the appointment of four new distributors: Iowa Spring & Body Co., 1401 West Grand Ave., Des Moines, Iowa; Granite Alaska Garage, 45 West Granite St., Butte, Mont.; Neil's Automotive Service Co., 167 East Kalamazoo Ave., Kalamazoo, Mich.; Mason & Holsinger Co., Johnstown, Penna.

Concrete by Pipeline

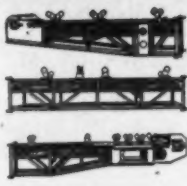
In a new catalog bearing this title and describing both the mechanism and application of Rex Pumpcrete, there is the announcement of a new Pumpcrete of small size capable of handling the output of a small mixer. This unit is mounted on pneumatic tires and is readily towable from job to job. The

rated capacity of this size Pumpcrete is from 15 to 20 cubic yards an hour, and it will pump concrete through a 6-inch diameter pipeline distances of 800 feet horizontally or 100 feet vertically.

The new catalog also contains many interesting job photographs showing the

various types of jobs, both large and small, to which Pumpcrete units are adaptable and descriptions and specifications of the various models. Copies of this Catalog 300 may be secured direct from the Chain Belt Co., 1666 West Bruce St., Milwaukee, Wis.

NEW WAYS TO CUT MATERIALS HANDLING COSTS



The flexibility and adaptability of the Porta "Model 347" sectional conveyor offers wide opportunities for cutting costs and increasing profit in the handling of concrete and aggregates.

Made up of independent sections. Can be used on wheel truck, caster mounting or on supports as permanent or semi-permanent conveyor.

Easily disassembled, easily transported, easily reassembled. Our catalog describes our complete line of portable, sectional, and permanent conveyors designed to suit every contractor's requirement.

PORTABLE MACHINERY CO., York, Pa.; Clifton, N. J.; Chicago, Ill.



NEW 1937 CHEVROLET TRUCKS



Greatest pulling power of any truck in the low-price field

Contractors and builders whose haulage requirements call for powerful truck units recognize the superior advantages of new Chevrolet 1½-ton trucks. For a combination of power and flexibility they are unmatched; for money-saving economy they are unequalled.

Chevrolet's New High-Compression Valve-in-Head Engine is a marvel of efficient, responsive power—the greatest pulling power of any low-priced truck. And just as important are the extra payload miles you get from a gallon of gasoline, the extra miles you get from every quart of oil.

Then, too, there's an extra measure of economy in long-wearing Chevrolet Perfected Hydraulic Brakes—the safest and smoothest ever developed. So it is with every important feature—frame, rear axle and transmission... they are built for hard service—thoroughly dependable, and leading in the economy of service they perform.

Take the step to greater truck satisfaction. See your Chevrolet dealer, and ask for a demonstration of 1937 Chevrolet trucks.

General Motors Installment Plan—monthly payments to suit your purse.

CHEVROLET MOTOR DIVISION, General Motors Sales Corporation, DETROIT, MICH.



Unmatched Economy
Proved in 10,244-Mile
"RIM OF THE NATION"
TEST RUN
With Half-Ton "Economy Model"
Pickup—1,000-Pound Load.



Location of Test... Round the Nation, Detroit to Detroit
Distance Traveled... 10,244.8 Miles
Gasoline Used... 483.8 Gallons
Oil Consumed... 7.5 Quarts
Water Used... 1 Quart
Gasoline Cost... \$101.86
Gasoline Mileage... 20.14 Miles per Gallon
Average Speed... 31.18 Miles per Hour
Running Time... 328 Hours, 31 Minutes
Gasoline Cost per Mile... \$.0099
Average Oil Mileage... 1,365.9 Miles per Qt.
Total Cost of Repair Parts... \$8.73
These records have been certified by the A.A.A.
Context Record as being officially correct.



FOR ECONOMICAL TRANSPORTATION

"MORE POWER per gallon LOWER COST per load"

Illinois Paving Job Affected by Hot Weather

(Continued from page 24)

Paving and Finishing

One man spotted and dumped the batches into the skip of the Koehring 27-E paver in which the batches were mixed for 63 seconds. Three puddlers spread the batches where necessary but worked more assiduously in clearing the front screed of the finishing machine of all concrete on both passes over all joints. Thus there was no chance for a large piece of aggregate to destroy the alignment of the joint and the second screed with its roll of grout filled the top of the joint with a material easily worked by the hand finishers and the joint finisher. With the progress made by the paver, the operator of the Lake-wood double screed was busy watching his joints. One man using a Jackson Vibro-Spade powered with a Lauson engine vibrated the concrete both sides of all joints and along the side forms.

Two finishers used an inverted T longitudinal float 14 feet long from a double rolling bridge. These same two men went back and used a 10-inch canvas belt and then a 10-foot dragging and checking straight-edge. Where low spots were found concrete was brought back and worked over with the 4-foot long-handled float and then rechecked. These men also edged the sides and roughed in the joints. Another man then broomed the surface with a fiber broom and edged the joints and sides.

Curing With Paper

The burlap was spread wet as soon as the finishers had completed their work and then from one to three men sprinkled the burlap over night. Before 10 A.M. the burlap was removed, the pavement straight-edged and completely blanketed with Sisalkraft paper in 75-foot lengths. All laps of the blankets were banked with earth. Where the paper went over the edge to seal in the moisture there, the same crew which pulled the forms and spread the Sisalkraft blanket piled earth against the edge of the slab. The paper blanket was left on for 3 days without further attention to complete the curing of the slab.

Personnel

Project 395, Section 108, composed of 5.63 miles of 20-foot concrete pavement, was awarded to Hurden Construction Co. of Springfield, Ill., for \$166,151.05. The work was in charge of John Keech, Superintendent for the contractor, and E. E. Hagglund was Resident Engineer for the Illinois Division of Highways.

Corrugated Sheet Piling

Standard or Interlock

Corrugated steel sheet piling, in standard or interlock sections, made by the Corrugated Steel Sheet Piling Corp., Builders Bldg., Chicago, Ill., has been used in the construction of dams, levees, cofferdams, bridges, bulkheads, locks, cut-off walls, water works, sewage treatment plants and sewer trenches.

This piling is rolled from open-hearth steel having a minimum tensile strength of 35,000 pounds per square inch. It is easily transported, handled and set by hand and driven either by hand or light power equipment. The depths and closeness of the corrugations are designed to give it rigidity and strength without unnecessary weight. The piling can be furnished in standard steel, copper-bearing steel, pure iron or galvanized. It has a high salvage value and has been re-used by contractors many times, in one case more than a hundred times, according to the manufacturer.

Standard sections, which are recommended for jobs on which the piling is

to be used temporarily, come in thicknesses of 11/64-inch, 9/64-inch, 1/8-inch and 7/64-inch. Locking clips, reinforced to prevent distortion, are electrically welded to the sheet. For permanent installations, the interlocking sections are recommended, though in many cases where soil conditions are favorable these sections have been used for temporary installations.

Complete information and specifications on this corrugated steel sheet piling are found in a 16-page illustrated booklet which may be secured direct from the manufacturer by mentioning this magazine.

The Provincial Department of Highways of Saskatchewan, Canada, has announced that a section of highway treated with calcium chloride has been so successful as an all-weather road that, because of its low cost, more highways of this type will be built, according to a report from the U. S. Bureau of Foreign and Domestic Commerce.

HERCULES IRONER ROLL

Remarkable results in eliminating high spots

Produces a road with unusual riding and wearing qualities in keeping with today's heavy requirements.

SCARIFIER ATTACHMENT
Delivers the full scarifying pressure along the entire row of teeth.
GRADER BLADE, SCARIFIER and IRONER ROLL make the HERCULES a complete, efficient maintenance unit.

THE HERCULES CO.
MARION, OHIO



WRITE FOR CIRCULAR "The Reasons Why"

QUICK-WAY'S

PROVED PERFORMANCE

Today we are selling 4 times as many truck shovels as in 1936 . . . 60% of them to fill Repeat Orders from Quick-Way users

REPEAT BUSINESS . . . that's proof of performance! One large California Utility company bought their first Quick-Way less than 3 months ago and just ordered another . . . a Texas Contractor recently added two more to make a fleet of four . . . another purchaser adds seven to the fifteen now in operation . . . everywhere, it's the same story . . . it's the Quick-Way story of proved performance—

EVERYWHERE, contractors and engineers are "sold" on Quick-Way Truck Shovels . . . are demanding them! They've seen them produce big yardage on all kinds of jobs and run rings around so-called truck shovels as well as bigger equipment . . . have seen them get in and out of, and operate in seemingly impossible places on one rear axle . . . THEY'VE proved that the Quick-Way is the best shovel.

QUICK-WAY TRUCK SHOVEL CO.
Denver, Colorado

★ Quickly Convertible into a Dragline, Crane, Trench Hoe, Pile Driver Clamshell, Orangepeel

The Quick-Way Truck Shovel Co.
DENVER, COLORADO



The QUICK-WAY "there" - The QUICK-WAY "to do the job" - The QUICK-WAY "to the next one!"

Contract Disputes And Arbitration

The first question which comes to mind in a discussion of arbitration under public construction contracts is "why a contract?" Why not organize a construction department and do work directly? Because the experience of many years indicates that the contract method is more economical and eliminates many evils connected with construction by day's work.

There are of course evils connected with contracting which are also obvious. However, once it has been determined by any community that it is advisable, in the public interest, to contract a certain construction, it is necessary that a reasonable profit be allowed to the contractor, as without this contracting cannot exist; and the contract must not be so drawn as deliberately to deprive the contractor of this reasonable profit.

At this point it will serve to inquire "What is a contract?" No better definition has ever been given than the old Anglo-Saxon one that a "contract is a meeting of the minds," that both parties agree on a certain statement of facts under which a definite piece of work is to be performed and for which a definite price is fixed. That being the case, it is the duty of the owner, through his engineers and architects, to establish by adequate investigation, by borings, etc., the conditions under which the work is to be done—especially so as the owner usually takes months or years to plan and investigate his work and the contractor is given only a few days in which to prepare his proposal or bid.

Lazarus White, President of Spencer, White & Prentiss, Inc., in an article on arbitration under public construction contracts in *The Arbitration Journal*, published by the American Arbitration Assn., states that in his experience the lack of proper investigation is the principal cause of difficulties in the carrying out of contracts and in the subsequent litigation. This is especially so where underground work is included, in which case it is expensive to secure the information. However, this is not beyond the resources of modern science. In the construction of the Catskill Aqueduct, many dam sites and over 100 miles of aqueduct lines were so thoroughly explored and reported on by competent geologists that very few surprises were met and little litigation followed a project which involved the expenditure of over \$200,000,000.

As investigations and adequate and complete designs are costly, and require considerable time in preparation, owners, public or private, are apt so to restrict the engineer or architect that vague or incomplete plans are offered, resulting in inadequate investigations of conditions, in which case a true "meeting of the minds" is improbable. As these defective contracts have led to extensive litigation, lawyers have sought to build up various defenses or waivers of responsibility for the accuracy of the estimates of quantities, for the information supplied, etc., and have attempted to give complete and arbitrary powers to the engineer or architect. Clauses in which the contractor guarantees the adequacy of the design are common and the contractor is often required to be an insurer for the owner against outside claims for damages, as in excavations, extending over a long period of time.

It can be seen that in the imperfectly prepared contract there is much danger of differences of opinion which often lead to litigation. It can also be seen how difficult it must be to adjust these cases in the ordinary law courts. It requires considerable technical ability properly to visualize these cases and, Mr. White states, in his experience some of the ablest jurists find it difficult to grasp the essence of a construction con-

tract.

Fortunately arbitration clauses are now commonly found in construction contracts. They greatly simplify the adjustment of differences of opinion as to payment. Under this method, each side chooses an expert to represent him. They in turn choose a third and the investigation is conducted as in court, but far more informally. Much time can be saved, as the expert arbitration board can go straight to the point and from their experience evaluate the claims. They are also far more immune to prejudice and worked up sympathy and much more liable to render a justly evaluated verdict than an ordinary court, in Mr. White's opinion. Their decisions are made binding by the laws of many states and are very difficult to upset.

Unfortunately arbitration clauses are not usually found in public contracts. The fact is that the duties of a public official are closely prescribed by the law and he hesitates to surrender any part of them to an arbitration board.

Then again, when a case against a public body involving a large sum is lost in the courts, it does not seem to excite public comment, as time dulls the memory of the public. Where a case is lost before a board of expert arbitrators, it carries more of a sting and involves a certain

amount of risk as to the personnel of the board, its manner of choosing, etc. However, arbitration is the right way—in the public interest, in the interest of justice and for the relief of the overburdened courts and, therefore, should be furthered in every legitimate way.

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A Type and Size for Every Job!



THE UNIVERSAL

Delivers 9000 vibration frequencies per minute.

You will secure a better quality of concrete at reduced labor and material costs with MALL vibrators. It will pay you to investigate this unit as well as the MALL gas engine sets. Complete information and prices will be gladly furnished.

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Another Bucyrus-Erie for

IMPERIAL IRRIGATION DISTRICT

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Bucyrus-Erie Co., South Milwaukee, Wis., U.S.A.
Two of Every Three Sales are Repeat Orders



Activities at the Site of the Republic Steel Co.'s New Strip Mill in Cleveland For Which the Cable Construction Co. of Canton Was the Subcontractor on Excavation. A Euclid Wagon Pulled by a Cietrac Model FD Is Shown Hauling Material Excavated by a Lorain 77

"Breaking In" Machinery And Its Lubrication

In starting up a new machine, the operator usually runs it below the rated speed and under reduced load and carefully watches to see that there is no excessive heating in the bearings and other moving parts, after which the load and speed are brought up to the rated capacities. In spite of this careful watching, it usually requires a rather long period of actual service before the machine is thoroughly broken in and operates in a normal manner.

One reason for this "breaking in" process is that even with the best technique in machining and finishing the working parts, the surfaces of the shafts, bearings, etc., are relatively rough and irregular as compared to the minimum thickness of the film of lubricant between them, according to an article in *The Lubriplate Film*, published by Fiske Bros. Refining Co., 129 Lockwood St., Newark, N.J. Thus even under rather light operating conditions, the high spot on the journals tend to strike those on the bearings, causing local breakdown of the lubricant film and corresponding increase in friction and heating. When these high spots come together, however, unless the surfaces are too rough or the load too great, a smoothing action takes place by tearing off particles on the high spots. This dissipation of metal is what is termed "wear".

The relation of the surface finish of metals to lubrication is a subject that has received no small amount of atten-

tion during the past few years. It is generally conceded that properly fitted and lubricated working parts never touch each other while in operation, but are held in spaced relation by the lubricat-

ing film. It has been said that finely finished surfaces can be considered not so much as bearing surfaces but as "races" on which the molecules of the lubricant roll. In the study of lubrication, engineers are today giving more attention to just what constitutes a finished surface with a view to obtaining a broader conception of the relation of lubrication to a finished surface, for after all it is the surface to which the lubricant film is attached.

Steel Reinforcing Bar Standards Reaffirmed

The Division of Simplified Practice of the National Bureau of Standards has announced that Simplified Practice Recommendation R26-30, Steel Reinforcing Bars, has again been reaffirmed without change by the Standing Committee of the industry.

This recommendation, which was proposed and developed by the industry, lists eleven sizes of reinforcing bars

with cross-sectional areas ranging from 0.05 to 1.56 square inches. It was first promulgated in 1925, revised in 1930, and was reaffirmed without change in 1934.

Printed copies of the recommendation may be secured from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5 cents each.

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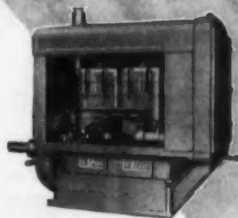
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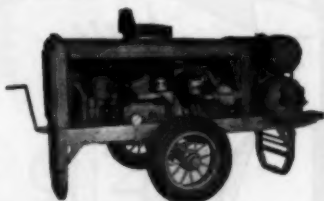
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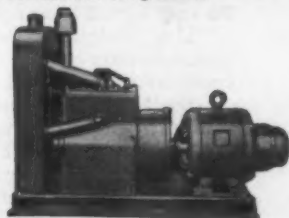
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LeRoi Engines, 4 to 400 H.P., the choice of the construction industry for tried, tested and proved power on all types of equipment. Designed by capable engineers and built by experienced, skilled mechanics with precision machinery in a modern plant to standards which assure dependability, low operating costs, and long service life.



Economical AIR

LeRoi-Rix Air Compressors are available in single or two stage, portable or stationary, all mountings . . . known for their capacity to provide cooler air and more air. Engine and compressor are both built in the LeRoi plant . . . to LeRoi's high standards of construction including spring mounting and other important features. Owners usually repeat on their original purchase of LeRoi-Rix Air Compressors.



Reliable LIGHT

LeRoi direct connected lighting Plants . . . 1 1/2 to 200KW . . . DC or AC, any size, voltage, or type . . . for continuous duty or stand-by service. Noted for silent, smooth operation . . . conservative speeds . . . long service life. Thousands in service on important construction projects and stand-by duty in power plants.

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THREE ESSENTIALS
TO SUCCESSFUL
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POWER AIR LIGHT

Value is built into LeRoi equipment — engine, air compressor, or lighting plant — through outstanding design, select materials, and precision standards in manufacture — LeRoi Engines, 4 to 400 H.P.; LeRoi-Rix Air Compressors — all mountings and sizes, single or two stage, portable or stationary; LeRoi Lighting Plants 1 1/2 K.W. to 200 K.W., AC or DC. Write for complete literature.

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INSIST ON:

- Faster, 100% Automatic Priming,
- Greater Efficiency in Any Size, at Any Lift,
- Thousands of Hours of Heavy Duty Service.
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THE JAEGER MACHINE CO.
701 Dublin Ave., Columbus, Ohio

JAEGER

LE ROI COMPANY, MILWAUKEE, WIS.

City Street Repair By State Contract

**Four State Routes in One
City Block in Phoenix, Ariz.,
Repaired and Widened by
Local Contractor**

FEDERAL and State routes, U. S. 60, 70, 80 and 89, run over the same city street when they enter Phoenix, Arizona. These well-traveled through-routes have attracted increasing traffic, both local and foreign, in the last few years and have required repairs and widening for four blocks. A contract was awarded to the Arizona Sand & Gravel Co. for this work which was completed during the summer of 1936. The pavement consisted of an old 2-inch bitulithic top on a 4-inch concrete base. Subgrade failures had caused cracks which were cut out 6 inches or wider with the use of jackhammers and points. Air for the work was furnished by an Ingersoll-Rand compressor mounted on an Autocar truck for easy shifting.

Where the work required the removal of considerable sections of the surface paving because it had become checkered, the base was irregularly grooved with the points to give a good key or bond between the base and the patches. Where there were high spots caused by utility patches or other work, the high spots were burned or heated with a home-made heater that proved effective for the small amount of this work required, and the excess material raked off. The heater consisted of one half of an oil drum, cut through from head to head with a half section of pipe inserted into it the long way to hold the commercial propane burner which provided the heat for the burning. This would only cover a very small area at one time but as the spots to be taken off were very small it functioned satisfactorily. It was found that at first the outfit would not work when placed close to the pavement. This was caused by the lack of air so the half drum was mounted on four legs that held it off the ground so that the burner could breathe.

Making the Patches

When the widened cracked areas and the patching areas had been cleaned thoroughly with a broom the edges were painted with Bitumuls LRM, a slow-breaking road-mix emulsion, to permit a tight seal against the entrance of water between the old and new material. A plant-mix patching material with maximum 2½-inch aggregate for base patching and 1¼-inch material for top patching and made with 50 to 60 penetration asphalt using 5 per cent asphalt for top and 4½ per cent for base was hauled to the job by GMC trucks.

The patching material was spread and tamped by hand in 2½-inch layers. The patches, some of which covered as much as half the roadway for half a block because of the widened sections, were rolled with a 10-ton Austin 3-wheel roller for base and an 8-ton Buffalo-Springfield tandem on top. The con-

tractor was required to paint the entire base course with the Bitumuls LRM when putting new top on old bituminous base.

Personnel

This work was done between 3rd and 7th Avenues in Phoenix, Ariz., on Van Buren Street by the Arizona Sand & Gravel Co. of that city with James Hess, Superintendent in charge. For the Arizona State Highway Department, the work was in charge of George E. Lang, Resident Engineer, under R. C. Perkins, District Engineer.

Diesel Attachment Marks Greasing Time

Henceforth an hour meter will be standard equipment on all 3, 4 and 6-cylinder and V-8 Caterpillar diesel engines, according to an announcement by the Caterpillar Tractor Co., Peoria, Ill. This meter was made available as an attachment about two years ago. The ones which have been used during this

period have proved the value of such an instrument and its use will eventually mean as much to the diesel engine owner and operator as the speedometer does to the automobile owner, according to the manufacturer.

The hour meter is a sturdy durable unit with a large easy-to-read dial. It is attached to the rear of the fuel injection pump housing and is driven by the end of the shaft, fitting between the

heads of the cap screws in the end of the fuel injection pump camshaft. It registers one number for every hour the engine operates at standard rated speed.

Just as the mileage indicator part of the speedometer has become the standard for measuring the life and maintenance intervals of the automobile, so the hour meter is designed to serve as a guide for lubricating and maintaining Caterpillar diesel engines.

**Hough-Universal Road Sweeper
Used in Fleets of From Five to
Eighteen by 27 State
Highway Depts.
and by Over 75
Bituminous Pav-
ing Contractors.**

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THE FRANK G. HOUGH CO.

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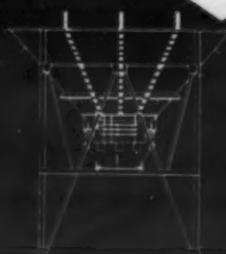
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VERSATILITY

Look ahead when you buy a bin and batcher, beyond your present job. Buy a versatile Blaw-Knox BATCHERPLANT—convertible to varying needs and specifications—to use on many jobs.

As your requirements change, add bin bulkheads at slight extra cost to suit your aggregate specifications.

The Weighing Batcher you buy originally is designed to accommodate extra weighing beams to meet these changing conditions, the cost of extra weighing beams is nominal.

Only at Blaw-Knox can you buy this changeability in a standard, shipped from stock, Batcherplant—with the added features of self-cleaning bin design; ease of erection; accurate, simple and dependable weighing batchers—and rugged construction to last through a number of jobs.

We will gladly send you complete details.

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Two usable edges:—

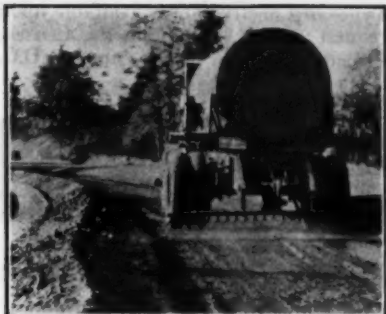
1. a rounded edge, for line point straightening
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Weight only 11½ lbs., yet very strong
Write for Price List No. 8

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10302 Barnes Road, Cleveland

BLAW-KNOX



Applying a Tack Coat of Raylig in Tacoma Park, Tacoma, Wash.

New Lignin Binder For Road Stabilization

(Continued from page 20)

Lignin should be applied on a wet surface, either following a moderate rain or after sprinkling. This aids penetration, prevents waste of material and provides the proper length of time in which material can set up in the desired manner.

Resurfacing a lignin-treated roadway can be done most effectively after a heavy rain. It is essential that the aggregates in the roadway be graded for maximum density. A good base is quite as necessary in this type of surfacing as in any other, as is adequate crown for proper drainage.

Costs

Construction and application costs with Raylig are approximately as follows, based on experience to date: dust treatment, \$200 to \$250 a mile, including material and application; double penetration treatment, \$350 to \$400 a mile, including material and application; and new construction by the build-up method, \$500 to \$600 a mile. The cost of the lignin binder is established at about 5 cents a gallon for the 46 per cent concentrated solution, at the mill. This means a cost of approximately 2½ cents a gallon for the 26 per cent solution ready to apply to the road surface, plus transportation and application costs. The State Highway Department of New Jersey reports that under its 1935 contract the cost of Raylig was 7.899 cents per gallon of concentrated liquor, furnished, delivered and applied to the road surface, including the necessary water for dilution.

Program of Elimination Of RR Grade Crossings

From the time the Federal highway program was established in 1916 until 1933, a period of 17 years, there were eliminated on the Federal-Aid system 6,000 grade crossings, 4,650 of them through highway relocations. Thomas H. MacDonald, Chief, U. S. Bureau of Public Roads, told the American Railway Engineering Association Convention in March.

The first authority to carry the entire construction costs of such improvements with Federal funds was granted in 1933. Under the provisions of the National Recovery Act of that year, 697 grade separations were constructed and 706 grade crossings protected by automatic warning devices. In 1935 funds were made available specifically for work of this character, and under this authorization a total of 854 grade crossings have been eliminated, 881 eliminations are under construction, and 371 programmed for construction, making a total of 2,106. In addition, 343 existing grade separation structures are being rebuilt, and automatic warning devices at 1,204 crossings have been installed or provided for. Thus, in a period of 3½ years 3,146 crossings have been eliminated, including the rebuilding and reconstruction of the 343 obsolete and dangerous crossing structures, and a

total of 1,910 standard protection signals have been provided for or installed.

Asphalt Institute Office Opened in Dallas, Texas

The Asphalt Institute, New York City, has announced the establishment of a Field Office at 613 Southwestern Life Bldg., Dallas, Tex. D. D. Williamson, formerly head of the Texas State Highway Laboratories, will be in charge of this office which will cover the states of Texas, Arkansas and Oklahoma.

After serving as First Lieutenant during the war, Mr. Williamson was employed in 1920 by the Mead Fibre Co., Kingsport, Tenn., as chemist and assistant superintendent. In 1926 he entered the employ of the Pittsburgh Testing Laboratory as laboratory head in charge of plant and field inspection of asphalt in Florida and Texas, which position he held until joining the Texas State Highway Department in 1933 as Chief of Laboratories.

STERLING BALANCED WHEEL BARROWS



Greater part of
load balanced
over wheel

No. S12 Barrow—For Dry Materials
Can Be Equipped with Solid Rubber Tire Wheel

A COMPLETE LINE OF STERLING WHEEL
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2 in 1

**3/4-yd. Lorain-40 Offers the Economy
of One-Boom Structure for Both
Backdigger and Shovel Service • •**

• Backdigger and shovel booms for the Lorain-40 are built exactly alike except that the former is equipped with a tubular torsional member above the shipper shaft. Simply install the shipper shaft assembly and "Presto," the backdigger becomes a shovel of full ¾-yd. capacity. Conversion is accomplished with equal ease and economy.

Profitable bidding demands the use of the most efficient tool for the job. The ¾-yd. Lorain-40 offers you interchangeable backdigger and shovel operation at a minimum equipment cost, enabling you to handle jobs more efficiently and at a greater profit.

LORAINS
MOVE MORE MATERIAL FASTER AT LOWER COST

THE UNIVERSAL CRANE COMPANY • LORAIN, OHIO

"Skin-Mat" Treatment For Wisconsin Roads

(Continued from page 22)

of four graders usually completes the mixing. The graders run at speeds of 5 to 6 miles an hour or about as fast as they can travel. Much time is lost in turning them and in waiting for the passing of traffic.

When mixing is completed the material is spread to a thickness of $\frac{1}{4}$ to $\frac{1}{2}$ inch and left for traffic to compact. If it is impossible to complete the work on a section in one day, the material is spread anyway and traffic is allowed to use the road. It has been found that the action of pneumatic tires on modern motor vehicles does a better job of completing the intimate mixing of the materials through its kneading action than the graders themselves. In the case where the work was spread at the end of the day because the mixing could not be completed, it is simply picked up in the morning and the mixing continued until complete.

Maintaining "Skin-Mat"

One of the important duties of the oil crew before the job is completed is to prepare a good supply of mixed oil and soil in one or several stockpiles handy to the surface. The patrolman can then use this "pre-mix" for filling holes that develop in the mat throughout the fall and even into extreme cold weather.

When these surface courses get rough through the action of frost the surface is cut up with a Baker disc in the spring and the whole reggraded with or without the addition of more asphaltic oil.

The work in Trempealeau County is under the direction of Glenn Growt, Assistant District Engineer in charge of maintenance, Frank Hewitt, County Patrol Superintendent, and Ernest Axxess, Foreman of the road crew.

Ban on Bright Headlights Decreases Accidents

A recent order banning bright headlights on Westchester County, N.Y., lighted parkways has decreased automobile accidents 50 per cent, it was reported in the New York *Herald Tribune*. This order was the result of an investigation by Thomas F. Reynolds, Director

of Safety for the parkways, which seemed to indicate that many of the accidents were being caused by drivers being blinded by the lights of approaching cars.

Permanent lighting from lamps installed along the parkways was restored to motorists the beginning of this year after having been shut off during the depression.

Volume III of Census Report On Types of Construction

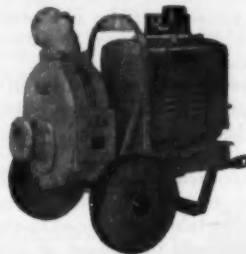
Of the work done by contractors in 1935, 18.5 per cent was in highway construction, 20.5 per cent for heavy construction and 61.0 per cent was for building, according to the report of the Census of Business, Volume III, which has recently been published by the Bureau of the Census. This volume is devoted to the types of construction carried on by the industry, comparisons between 1929 and 1935, and detailed information about the 46,429 contracting firms which

accounted for work amounting to \$1,330,835,000.

A limited supply of this report on

Types of Construction is available upon request at the Bureau of the Census, Philadelphia, Pa., or Washington, D.C.

REX SPEED PRIME PUMPS ...



MOST GALLONS PER DOLLAR!

THE CONTRACTOR'S GREATEST WATER MOVER

The new Speed Prime Pumps have everything that makes for economical and dependable water-moving—Greatest air-handling capacity—Completely automatic Prime Control—The Only Positive Recirculation Cut-off . . . There are sizes to meet the needs of any job—no matter what the gallonage—from the little 2"-7M to the husky 8"-125M . . . They make dewatering jobs real money-makers. . .

Send for the new Pump Bulletin!

CHAIN BELT COMPANY

1666 West Bruce Street, Milwaukee, Wisconsin

REX CHAIN BELT COMPANY OF MILWAUKEE CONSTRUCTION EQUIPMENT



TRUCK operating records show that it is false economy—*deliberately wasteful*—to overburden lighter trucks with crushing loads. Only engineered-for-the-job trucks, of which GMC's are admittedly the leaders, can handle the heavier loads with positive assurance of minimum-cost operation . . . GMC trucks are built with extra safety factors—stouter frames, multi-leaved springs, husky axles and bearings to shoulder heavy loads

—yet there's not one pound of superfluous weight to carry around at the expense of gas and tires . . . As for power and downright pulling ability, the ratio of GMC's torque to chassis weight (proved in published comparisons) exceeds competition! . . . The expansive line ($\frac{1}{2}$ to 12 tons) was laid out so you could choose a truck with the ideal combination of size, power and equipment to exactly fit your haulage problem. See GMC.

QUALITY AT PRICES LOWER THAN AVERAGE

Time payments through our own Y. M. A. C. Plan at lowest available rates

GENERAL MOTORS TRUCKS & TRAILERS

GENERAL MOTORS TRUCK & COACH

DIVISION OF

YELLOW TRUCK & COACH MANUFACTURING COMPANY, PONTIAC, MICHIGAN

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BOOKS ON WELDING
TELL HOW YOU CAN
SAVE LARGE SUMS
ON MAINTENANCE

Write Today!

\$200 to \$300 extra profit
monthly with this new "Simplified" Arc Welding.

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Get 30 Days' Trial at our
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pense to you. Write for
free book to Hobart Bros.,
Box CE-67, Troy, Ohio. One
of the World's Largest
Builders of Arc Welders.

HOBART

THE FASTEST SELLING WELDER ON THE MARKET TODAY

Channel Change At Goshen, N. Y.

(Continued from page 16)

chines farther from the river bank, a novel series of set-ups was used. One of the Marion outfits was rigged with the 70-foot boom at an angle of about 60 degrees with the horizontal and carrying a slackline cable, the far end of which was attached to the rear of an RD-8 diesel tractor which moved the sheave and cable along the opposite shore as needed. For some time before the tractor was available, two heavily loaded stone boats were used on the opposite shore with about 100 feet of cable between them and the sheave attached to that cable.

For sloping, the cross-channel cable was used as a hoist and backline, carrying a 1½-yard Page dragline bucket, because this method, although slower in hourly output, gave greater accuracy in cutting the slopes on the far side. For digging the 70-foot bottom of the channel the same outfit was used without the backline so that the dragline bucket operated as a gravity single-line slackline. Return speeds up to 700 feet a minute were possible with this rig which greatly increased the hourly volume of excavation.

With both these rigs the excavated material was dumped in front of the dragline which, because of the set-up, could not swing and dispose of the material beyond the berm. After a sufficient section of the channel had been excavated and cleaned with the two set-ups described above, the machine was then re-rigged as an ordinary dragline which moved the spoil pile and at the same time trimmed the slope on the near side, disposing of the material beyond the berm but still within the narrow 300-foot right-of-way.

Lighting

Inasmuch as a considerable volume of work was carried on at night, Kohler 1,500-watt floodlights were provided for each dragline. The Koehring and Marion draglines were equipped with heavy-duty American Bosch magnetos. In addition, several lighting plants in small houses mounted on skids were used on the job. These consisted of Fairbanks-Morse gas engines driving F-M generators delivering current to groups of 100-watt lights in gang reflectors.

Personnel

All work on the Wallkill River Flood Control Project was suspended on March 31, 1937 because of lack of funds. Thirteen of the fourteen CCC companies employed on the work have either been demobilized or transferred to other work locations in New York State.

The completed section of the project, which was under the direction of Col. Edmund L. Daley, District Engineer, U. S. E. D., with headquarters in New York City, extends from Pellets Island Mountain Bridge to a point about a mile below the Erie Railroad Bridge, a distance of about 4 miles. Capt. B. C. Snow was Area Engineer in charge, with

headquarters in New Hampton, N. Y., assisted by Col. H. C. Byrnes who was General Superintendent, with three Divisional Superintendents, William F. Keyes, H. G. Lowell and E. H. LeRoy. The CCC labor was directed by civilian foremen. Their work consisted of clearing, trimming slopes, maintaining roads and placing riprap on the channel banks.

New Mich. Representative Announced by Air-Maze

The Air-Maze Corp., Cleveland, Ohio, has announced the appointment of W. G. Heacock, who joined the Air-Maze organization in 1928, as Michigan factory representative for that company. Mr. Heacock will make his headquarters at the offices of the Barton D. Wood Co., Inc., Manufacturers Bldg., 2832 East Grand Blvd., Detroit. Heretofore Mr. Heacock, as Sales Manager, traveled over the entire United States but from now on, his activities will be concentrated intensively in Michigan.

South Bend

Bituminous Material Distributor

EMBODYING 29 YEARS' EXPERIENCE

ECONOMICAL • EFFICIENT • STURDY
NON-DRIP SPRAY BARS • QUICK SHUT-OFF
ACCURATE APPLICATION • IMPROVED HEATING

MUNICIPAL SUPPLY COMPANY
SOUTH BEND • INDIANA



HOOT MON!!
YOU CAN SAVE
MONEY
IF YOU USE A CEDAR
RAPIDS PLANT ON
YOUR NEXT JOB -
TURN TO IOWA FOR PROFIT
-BE THRIFTY!!!



C. & E. M. Photo

The Superintendent on This Job Insisted on Regular, Thorough Lubrication of the Draglines



IOWA MANUFACTURING CO.

CEDAR RAPIDS, IOWA

"Performance Is What Counts"

Avoid Legal Pitfalls

These brief abstracts of court decisions may aid you. Local ordinances or state laws may alter conditions in your community. If in doubt consult your own attorney.

Edited by A. L. H. STREET, Attorney-at-Law.

"Use Tax" Decision Hits Contractors in Some States

Ohio, Illinois, Washington and other states have recently enacted laws, designed to subject to taxation transactions not amenable to the sales tax laws. These laws, usually called "use tax" laws, tax the use or consumption of personal property, as distinguished from a sale. Application of the "use tax" statutes to contractors is resulting in considerable litigation, the outcome of which will be of no little importance to the industry.

Very lately, the Illinois Supreme Court has ruled that the local statute, imposing taxes on tangible personal property sold or transferred for use or consumption and not for resale, applies to contractors who furnish materials and supplies used in the construction of a project, although they are incorporated into realty before the contractor transfers title to them to the owner. The Court says (R. S. Blome Co. v. Ames, 6 N. E. 2d, 841):

"Appellants"—contractors—"at no time acquire or transfer title to any interest in real estate. The real estate at all times is the real estate of the owners with whom appellants contract. It makes no difference that the moment the title to the personal property leaves appellants and vests in such owners of real estate, by operation of law it becomes . . . real instead of personal property. The fact remains that all the title the appellants transfer, whether by sale or accession, is title to personal property."

But the court holds, that although the tax can be computed on the price of fabricated materials or equipment transferred to owners, the service involved in construction or repair is not taxable.

"Look to Your Bond!"

"Mr. Contractor, you must pay the cash and door company \$750 to reimburse them for an attorney's fee they paid out in suing you for the price of materials furnished," declared a district judge in Texas.

"But your Honor, why should I pay my enemy the cost of ammunition he fires at me? I thought I had a good defense against the company's claim and have to pay my own attorneys."

"Contractor, you seem to overlook the bond you signed when you got the building contract," rejoined the judge. "It bound you and your surety to pay all subcontractors, workmen and materialmen and expressly declared: 'Should the obligees be put to any expense for the enforcement of this contract or bond, the same shall be paid by the principal'—which means you—and surety.' \$750 is a reasonable fee for the services rendered by the cash and door company's attorney, and is part of the company's 'expense for the enforcement of this contract or bond.'"

"I think you are wrong, Judge, and I am going to ask the Texas Court of Civil Appeals to set aside your ruling," replied the contractor.

But the higher court found that the trial judge had not gone wrong in his legal view of the case. (H. Horace Williams Co. v. Vandaveer, Brown & Stoy, 84 S. W. 2d, 333).

Moral: Every contractor should read his bonds carefully before signing them. Then he should read them a dozen times again before he gets messed up in litigation.

Public Contract Proceeds

"There are no strings on the proceeds of a public construction job specially available to subcontractors, materialmen, excepting as expressly provided by statute," in effect declared the Alabama Supreme Court in the case of Wade v. Brantley & Crawley Construction Co., 161 S. 101. In other words, there is no implied lien against such proceeds. And

where the only statutory security afforded the subs., etc., is a bond given to secure the payment of their claims, they stand, in all other respects, as mere unsecured creditors of the contractor, ranking with his other unsecured creditors.

In fact, the court notes that the very reason for providing for a statutory bond arises from the circumstance that subcontractors have no lien on the property of the contractor or on his earnings. And referring to statutory provision for a bond to secure the payment of subcontractors, materialmen, etc., the court adds:

"The security thus provided for the materialmen also tends to show a purpose to enable the contractor to be free from embarrassment so that without obstruction by them he may assign the account due him by the state to obtain financial aid, or may deposit the funds in bank with other money and be free to operate his business without hindrance from materialmen protected by the bond."

When Liability Policy Misdescribes Vehicles

Better go to your safe and make sure that the policies insuring you against liability for injuries that may arise in the operation of your vehicles properly describe the vehicles.

This warning is inspired by the decision of the Louisiana Supreme Court in the recent case of Geo. D. Geddes Undertaking & Embalming Co. v. Home Accident Insurance Co., 134 So. 905, where it took litigation in two courts to establish the rights of insured under a policy that, through mistake, described an automobile that had been demolished, instead of one that took its place.

It was not until the omitted car got into an accident that killed six people and injured one more that it was discovered that the car was not included in the fleet described in the policy. Then the insurance company said that it was under no liability.

But the Supreme Court decided that the insured company was entitled to have the policy corrected to read the way it should have read, even after the accident, and to recover on the policy the same as if it had read the way it should at the time of the accident.

The decision was influenced by the fact that the insurance company had undertaken, as part of its service to policyholders, to secure all necessary data concerning the cars to be insured, etc. The court said:

"Manifestly, defendant did not perform its

duty to plaintiff in this respect, and plaintiff, relying upon the service promised by defendant, did not examine the policies and check over the serial numbers of the sedans therein included. Hence the misdescription of the sedan arose from mutual mistake."

"Let the Buyer Beware!"


"I insist on an allowance of damages because there were defects in the material you furnished us," declared a Texas contractor to a supply company.

"We can not see where you have a just claim," replied the company, "because the defects were not vital and could have been easily remedied. The defects were either observed by you before you used the material or could have been discovered on reasonable inspection. Your acceptance and use of the material under such conditions lets us out."

But it took two court decisions to convince the contractor that the material man had the law on his side. The first legal round was fought in the district court in Houston, and the second, on an appeal, in the Texas Court of Civil Appeals in Galveston.

"If," said the higher court (H. Horace Williams Co. v. Vandaveer, Brown & Stoy, 84 S. W. 2d, 333), "the purchaser accepts the goods without protest, especially after inspection or an opportunity to inspect, he waives the defects in the quality."

They'll do it better!



Don't skimp on lubrication. Running dry for only a few minutes can ruin a drill. When a drill is getting enough oil, it will show on the drill-rod shanks. Use Texaco, and be sure.

THEY'LL just naturally turn in a better day's work . . . put down more holes . . . and deeper holes . . . when they don't have to fuss with their drills. The drills themselves will match . . . foot for foot . . . the capacity of the men . . . when lubricated with Texaco air-tool lubricants.

Whether your operations are dry or wet makes a big difference in the oil your drills should get.

You don't need to compromise . . . you can get Texaco Lubricants that are exactly suited to your drills and your peculiar operating conditions.

You can be sure of a big day's work

. . . every day . . . for each drill, when it's on Texaco. And *this* is all anyone can expect of either his men or his drills.

Above all, don't attempt to save money on air-tool lubricants . . . you'll end by having to spend several times more than your "savings" on repairs.

Trained lubrication engineers are available for consultation on the selection and application of

Texaco Petroleum Products. Prompt deliveries assured through 2020 warehouse plants throughout the United States. The Texas Company, 135 East 42nd Street, New York City.



TEXACO Industrial Lubricants



**Concrete VIBRATORS
AND GRINDERS**

Write for Circular on types, sizes and prices

White Mfg. Co.
ELKHART INDIANA



An Attractive Yet Inexpensive Bridge Which Replaced a Failing Structure in Knox Township, Jefferson County, Ohio

Minn. Highway Patrol Performs Safety Service

The Minnesota state highway patrol traveled 1,104,310 miles during the first three months of 1937, according to a report from John P. Arnoldy, Chief Highway Patrol Officer, of the Traffic Patrol Division, Minnesota Department of Highways. In these three months, the patrol stopped and weighed 1,224 trucks, tested 4,334 motor vehicles for lights and 1,117 for brakes, examined 11,368 operators for driver's licenses, checked equipment in 3,335 cases and attended 211 accidents on the highways, first aid being given in seventeen cases.

Because of a sharp increase in the volume of traffic and accidents between the hours of 5 and 7 p.m., all highway patrolmen have been ordered to be on duty on the highways between those hours. Schedules have been so arranged that other work is performed at other times.

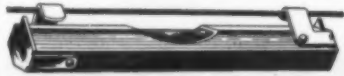
Both automobiles and motorcycles are used by the Minnesota highway patrol, depending on the condition of the roads and the weather. In general, motorcycles are used in the daytime in good weather on hard surfaced roads. Because of the state's rigorous climate, automobiles are used during the winter, and at night, when the men patrol in pairs, it is of course more economical to use one automobile rather than two motorcycles. The equipment of the patrol includes 80 motorcycles and 56 automobiles.

The state is divided into two divisions with a captain in charge of each division, the divisions then being subdivided into two districts, each supervised by a district captain. Forty patrol stations are located throughout the state. Equipment is maintained at these stations and reports relayed to and from headquarters and the individual patrolmen in the field.

The work of highway patrolling is under the direction of N. S. Elsberg, Commissioner, Minnesota Department of Highways, with John P. Arnoldy, Chief State Highway Patrol Officer, in direct charge of the Traffic Patrol Division.

The Civil Engineering Bureau under the General Affairs Board of the State Council of Manchuria has announced allotments for highway construction,

SAND'S-STEVEN'S Line & Surface LEVEL



Endorsed and adopted by Road Builders and Contractors

Level is easily and quickly attached to line. Special feature construction prevents accidental detachment from line. Construction is sturdy, and accuracy, guaranteed.

SAND'S LEVEL & TOOL CO.
8631 Gratiot Ave. Detroit, Mich.

streets and bridges amounting to \$2,403,000 in the 1937 budget. This Bureau was recently created to take over the functions of the former Highway Construction and Civil Engineering Bureau of the Civil Affairs Department.

Inexpensive Bridge Built by Ohio County

An interesting example of a modern inexpensive small bridge was constructed in Knox Township, Jefferson County, Ohio, by the Board of County Commissioners. The problem confronting the highway engineer was one of replacement of a failing structure. A new structure was necessary, as was also economy.

The new bridge has a clear height of 8 feet 6 inches and accommodates a 23-foot roadway. It has two arches, each with a span of 20 feet and a rise of 6 feet 6 inches. Toncan iron section plate arches were used. The stone for the headwalls of the new structure was salvaged from the old bridge. The total cost of the bridge replacement was \$6,000, one third of which was for materials and two thirds for labor. The WPA furnished all the labor involved while the materials were furnished by the Board of County Com-

missioners of Jefferson County.

The design and supervision of construction of the bridge was under the direction of Carl L. Glensey, Deputy County Engineer for Jefferson County.

All things may come to him who waits, but here's a rule that's slicker. The man who goes for what he wants will get it all the quicker.—CMC Bulletin.

HIGH CAPACITY 4" PUMP Self-Cleaning; high suction lift



Self-priming

- Open type trash impeller
- 4-cylinder engine
- Spring Mounted

FIG. 420

MARLOW PUMPS
RIDGEWOOD, N. J.

AUSTIN-WESTERN HYDRAULIC CONTROLS

- RIGIDITY
- RESPONSE
- EASE
- ACCURACY



MAKE THESE MACHINES

Outperform

Hydraulically Controlled
Austin-Western Machines

ROLL-A-PLANE
ROLLERS
BLADE GRADER
MOTOR SWEEPER
12-YD. SCRAPERS
MOTOR GRADERS
SNOW PLOWS
GIANT RIPPERS
ELEVATING GRADERS

• Wherever high operating efficiency calls for a combination of power, speed, and accurate adjustments, Austin-Western specifies hydraulic controls. The positive action and ease of operation of these controls are an important reason for Austin-Western's acknowledged leadership in earth moving and road building equipment.

Hydraulic controls give the power you need where and when you want it. They give you instant response—no lost motion or lag due to wear in gears and pinions; and the moment the control is in neutral it locks immovably.

Introduced in the Motor Grader five years ago, hydraulic controls are now used on practically every machine that Austin-Western builds.

Their value to the owner has been proved in use. Their economy of operation and maintenance are acknowledged by contractors and public officials everywhere.

THE AUSTIN-WESTERN ROAD MACHINERY CO., Y, Aurora, Illinois

Austin-Western

Experimental Binder For Oregon Jetty

(Continued from page 19)

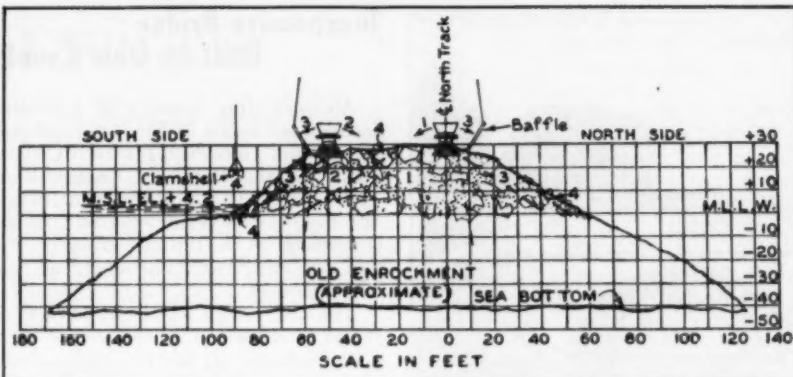
Forty-five per cent of the enrockment is in pieces weighing from 6 to 25 tons with an average of about 12½ tons, and less than 20 per cent by weight is of pieces weighing less than one ton. On account of the large sizes of most of the rock, and the need for conserving the heat in the mastic, it was decided that it should be handled in as large quantities as possible and at high temperature. It was accordingly decided to handle the mix in 10-ton dump buckets with three mounted on each flat car.

Preliminary tests made by the Asphalt Institute and by F. C. Field, Consultant on the work, showed that a satisfactory mastic could be secured by using 14 to 18 per cent of asphalt and 86 to 82 per cent of local beach sand without a filler.

The flash point of the asphalt was 500 degrees and the sand was heated in the driers to about 590 degrees. After passing through the elevator and scales the sand had a temperature a little under 500 degrees. The asphalt, delivered in tank cars from California, an 800-mile haul, arrived with a temperature of about 215 degrees and was reheated by steam to about 315 degrees. When dumped from the mixer into the buckets, the mix had a temperature of about 450 degrees Fahrenheit. The loss of temperature in transit to the jetty head, 3½ miles, was about 20 degrees measured at a point about 4 inches under the surface in the bucket. The loss in the center of the mass was no doubt very much less.

Dumping the Mastic

The time required for hauling was about 25 minutes, and the material was then dumped directly into the enrockment with a crane lifting one side of the bucket. Dumping was in general continued at one point until the voids were filled or at least until no more material would go in. Material was placed in the interior first with a view to building up a solid mass free from the action of the waves which almost continually wash against the structure. As the interior voids were filled, the work progressed to the outer slopes and finally along the water lines. Material



A Cross Section of South Jetty, Showing Successive Positions for Dumping Asphaltic Mastic

was dumped with a clamshell bucket on the outer slopes.

Difficulty was experienced in securing satisfactory placement along the toe of the slope between low and high water. The range of tide is about 8 feet and normally there is a surge to the sea and waves that break on the enrockment

even under the best summer conditions, and it is not possible for men to work at this level to assist in placing or consolidating the mastic. If the mix is allowed to run down the slope in a plastic mass, on striking the waves it is very largely and quickly changed to a frothy porous emulsion of a consistency which

is washed away and does not adhere to the rocks or stay in the voids. This is undoubtedly the weak point in the superstructure and is the point at which the action of the sea during storms is the most destructive.

Penetration

Since the mix was poured into the enrockment which had a height of 25 to 26 feet above low water, the actual depth of penetration could not be observed. During the course of the work, however, while dumping into the interior from positions 1 and 2, shown in the cross section, steam in considerable volume was observed to rise out of the enrockment, indicating that the hot material had reached at least to the water level. Also while dumping from the north track, position 1, steam was seen to rise south of the south track, indicating that the mix flowed laterally a considerable distance. Observations on the slopes indicate that, as the interior voids become filled, the material takes

(Continued on page 49)

NEW 4-WHEEL-DRIVE EARTH MOVERS POWERED WITH HERCULES ENGINES



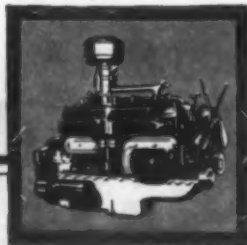
Hauling twelve-yard loads through deep sand, the new Oshkosh 4-wheel-drive earth movers—powered with Hercules Engines—are helping to push through the Knowlton Dam Project, north of Stevens Point, Wisconsin. With a speed of up to forty miles an hour, this equipment provides the contractor with a fast, rubber-tired, earth-moving unit, particularly useful where the going is tough

and the time element is important. Builders of specialized, heavy-duty contracting equipment naturally turn to Hercules for rugged, dependable power plants—either gasoline or Diesel. For over twenty years Hercules has specialized in the design and construction of heavy-duty engines only. This long experience is at the service of manufacturers of powered equipment.

HERCULES MOTORS CORPORATION, CANTON, OHIO

America's Foremost Engine Manufacturer • Power Plants from 4 to 200 H.P.

HERCULES



ENGINES

**SIMPLE
RUGGED
DEPENDABLE**

**The Pump Choice
of America**



Regardless of your requirements—there's a Sterling Quality Pump for every job—from the smallest 2" pump to the husky 10" pump designed for big volume work.

Specify **STERLING** and be assured of successful performance by these **THOROUGHLY TRIED AND PROVEN PUMPS**.

Write today for literature and prices.

Sterling
Machinery Corporation
8140 E. Northway, St. Louis, Mo.



The Completed Structure

New Laminated Timber And Concrete Bridge

(Continued from page 29)

Concreting

In continuous type bridges, it is important to consider a sequence of concreting operations which will insure freedom from cracking in the roadway slab. In order to avoid a possibility of this, the following method of concreting was adopted and carried out in the Mill Creek Bridge. The mid-span sections, between quarter points, of each span were poured in the first operation. On the next and final operation, the intervening portions, over the supports, were poured. Construction joints only were made.

Ample steel reinforcement of the concrete was provided to take care of tensile stresses developed over the supports and throughout the span length due to traffic loads in adjacent spans. In general, the reinforcing was $\frac{5}{8}$ -inch round bars on 9-inch centers each way.

A roadway crown of $1\frac{1}{2}$ inches was provided by increasing the thickness of the concrete from 4 inches at the curbs to $5\frac{1}{2}$ inches at the center line of the roadway. A vertical camber of 3 inches in the bridge as a whole was also provided. This was accomplished by ad-

justing the levels of the supports.

Forms were required for the curbs and hand rails only. These forms were supported by horizontal transverse timbers bolted to the under side of the deck, extending out a sufficient distance to accomplish the purpose. The concrete of the curbs extends around and to the bottom edge of the timber subdeck, giving the appearance of a massive girder throughout the length of the structure.

The lumber for the floor was dense structural southern pine, with an extreme fiber stress in bending of 1,600 pounds per square inch and pressure creosoted in accordance with the specifications of the Delaware State Highway Department. A. G. Livingston is Bridge Engineer for the Department.

Text and illustrations, courtesy of the American Wood-Preservers' Association.

Subsurface Exploration By Electrical Methods

The Shepard earth resistivity meter and the Lee Geoscope are two new instruments for conducting subsurface explorations, such as locating depth and subsurface contours of rock strata, gravel beds, clay, shale, etc., recently announced by the American Instrument Co., Inc., 8010-8020 Georgia Ave., Silver Spring, Md.

Both instruments, which are applicable to any depth from 3 to 2,500 feet, are now in use for road grading operations, classification of excavation materials in highway construction, location of sand and gravel deposits, foundation exploration, determinations of depths to solid bottom in marshes, location of water-bearing strata, etc. Engineers of the U. S. Bureau of Public Roads, using the Shepard meter, have developed a rapid technique which enables a crew of only two engineers and two assistants to make from ten to twenty shallow tests in one day. The Lee Geoscope is

now in use by the U. S. Bureau of Mines. State highway departments are also using the instruments. Bulletin No. 2052, describing these two new instruments, may be secured by interested contractors and engineers direct from the American Instrument Co. by mentioning this magazine.

Earth Moving Costs

A new 80-page booklet entitled "Modern Methods of Moving Earth" has recently been published by the Cleveland Tractor Co., Cleveland, Ohio. This

book contains a large amount of information on figuring earth moving costs, including the factors which influence earth-moving estimates, estimated costs of operation of tractors, the various types of earth-moving equipment and some short cuts in estimating, as well as some very interesting job photographs showing different kinds of earth-moving equipment in action.

Although this edition is limited, copies are available to readers of CONTRACTORS AND ENGINEERS MONTHLY who write promptly direct to the Cleveland Tractor Co. and mention this magazine.

Speed



NEW CMC MIXERS



CMC 7s and 10s End Discharge Mixers. New—compact—fast. The advantages of a speedy trailer with four wheel stability.



CMC 5s-7s-10s Two Wheelers. The fastest moving—fastest working one and two bag Mixers ever developed.

MONEY-MAKING EQUIPMENT FOR THE CONTRACTOR!

Mixers and equipment that meet today's demand for speed and portability. Greatest equipment values ever offered by anyone any time. New catalog shows the full line of CMC Mixers—all sizes—Wonder Tilters—Dumpover Pneumatic Tired Carts (See illustrations), Hoists, Pumps, Saw Rigs, Wheelbarrows.

Write today for your copy!

CONSTRUCTION MACHINERY COMPANY,

Waterloo, Iowa

30 YEARS...

RIGHT

This Portable Roller is increased in weight to 8600 lbs. when roll is filled with water. Suitable for patch, lawns, drives, etc.



EXPERIENCE BEHIND EVERY GALION ROAD ROLLER

Nearly a third of a century of constant improvement and study is behind every Galion unit. Self-satisfaction isn't in our book, because Galion engineers continually strive to make Galion the best on the road. Let us demonstrate.

LEFT

"The Warrior." Weighs five to ten tons. Hydraulic steering, powered by six-cylinder engine.



ABOVE

"The Chief." Ten to fifteen tons with hydraulic steering. Can be furnished with electric starter, scarifier and sprinkler.



LEFT

The Standard Tandem does the work of a series of tandems. Hydraulic steering and water sprinkling equipment available.

ABOVE

The Trench Roller is an entirely new type of roller to meet a long felt need. Used for repair, widening, relocation, elevating curves and some types of new construction work.

GALION ROAD MACHINERY

points to better roads

THE GALION IRON WORKS & MFG. CO.

GALION, OHIO
National Distribution

Excavation for All-American Canal

(Continued from page 15)

and a small Northwest shovel, brought from another job at times, finish the slopes, the bottom and berms being leveled with LeTourneau bulldozers. Sand and gravel below the mesa floor are heavier than the blow sand, and are spread over the berms as a blanket to hold the light sand from blowing back into the canal during storms. A Caterpillar Fifty, with a Euclid crawler wagon, hauls fuel oil over the dunes to the machines.

2 Miles of Hard Material

At the other end of the Callahan contract, about 2 miles containing some conglomerate and rock excavation remains. As much of the surface as possible has been stripped off with the firm's other 10-W Monighan, supplemented at times by a smaller dragline. After digging a short section of new channel for the Yuma canal, so that the All-American could occupy the old site, these machines moved to a 931,000-cubic yard subcontract near the canal head. This was common excavation, and while it was being removed a crew drilled and blasted the 2 miles of hard material mentioned, using one or more Cleveland D-14 wagon drills, a Bucyrus-Armstrong drill and several Ingersoll-Rand R-39 jackhammers. Holes reached a maximum depth of 60 feet. Compressed air was piped through a 4-inch line from a Sullivan Class WJ-3 17-10 $\frac{1}{4}$ x 12 stationary compressor, driven by V belt from a 200-hp Westinghouse motor. A 4 x 20-foot storage tank was used and air was filtered by a special air cleaner designed by Major L. D. Crawford, Vice President of the firm.

4 Miles of Pollock and "Subs"

The contract for 4 miles of canal from Laguna Dam to Station 50, below the new dam, was awarded to the George Pollock Co. of Sacramento, Calif., at \$750,000. Of this, 1,314,000 cubic yards is common excavation and includes the Callahan subcontract mentioned. There is 691,000 cubic yards of compacted embankment, sublet to Lewis Construction Co. of Los Angeles. Some 652,000 cubic yards of rock, in a cut 1,700 feet long, with a bottom width of 94 feet and maximum depth of 86 feet, is being removed by Pollock, using 260,000 cubic yards of the rock to blanket the outside of the compacted fill mentioned, which is just east of the cut. A Cleveland wagon drill was used in the main section, which was removed in 30-foot lifts, and fourteen Sullivan jackhammers were used on the slopes, where the holes reached a maximum depth of 22 feet. The deepest holes were sprung three times, using from one to five cases of Trojan stick powder for springing and up to 18 cases for loading. The hardest rock was broken with 40 per cent T.N.T. of government stock. The softer areas were loaded with B.B. black powder and in a wet section of about 200 feet at the east portal of the cut 40 per cent gelatin stick was used. About $\frac{3}{4}$ pound of explosive per cubic yard was required.

Firing was done with a Hercules machine. Compressed air was furnished by a Laidlaw stationary compressor, at the shops near the east portal, and by an Ingersoll-Rand portable unit which also furnished air to the jackhammers for drilling a number of rocky points which jutted into the canal east of the cut. Rock is loaded with a 2 $\frac{1}{2}$ -yard Marion electric shovel, into 8-yard Sterling trucks. A Caterpillar Seventy-Five is used in cleaning up the pit and sloping.

Compacted Fill and Well Water

The 8,200 feet of compacted fill un-

der subcontract to the Lewis Construction Co. is 144 feet wide at the bottom, 27 feet at the top and is 26 feet high. Sheet piling 20 and 30 feet long was driven under the embankment and the ground thoroughly bond-plowed. Selected material is being hauled from a borrow pit about 2 miles from the fill, in Ford V-8 dump trucks with 16 $\frac{1}{2}$ -yard Fager steel bodies. At the pit, borders are thrown up with a bulldozer and a large area is kept ponded ahead of the 2 $\frac{1}{2}$ -yard Northwest diesel-powered shovel. Water is supplied through a 4-inch pipe from a Worthington and an Allis-Chalmers electrically driven pump, located at a well near the fill. Besides adding most of the water required, this pre-irrigation eliminates the dust nuisance in loading and hauling extremely dry material.

The trucks travel at 30 to 35 miles per hour both ways, over a smooth private road, from which outside traffic is barred, and which is maintained every 8 hours by the contractor. They slow down only on entering the fill over ramps from the bottom of the canal. The dirt is dumped in rows and then spread with LeTourneau bulldozers on Caterpillar RD-8's. Rocks over 5 inches are then removed, after which the 6-inch layer of dirt is compacted with tandem sheepsfoot rollers which make several trips over the fill. The area is then sprinkled from a tank truck to bring the moisture up to requirements indicated by tests. The inner slope of the fill is blanketed with 12 inches of selected pit-run gravel.

Methods on Compacted Lining

At various points along the course of the canal, where excavation is in porous or unsuitable material, or where much of the water is held back by embankment, a compacted lining of selected material is being placed, with a toe in some cases extending well into the bottom of the canal. Excavation back of the regular line is usually provided for in the original contract for digging the canal, but the lining fills are made under separate contracts.

The contract for 8,045 linear feet of such fills near Picacho Wash was awarded to Pollock Construction Co. for \$122,000. Ten separate jobs were involved, the longest 3,100 feet. The average haul from a selected borrow pit was 2 $\frac{1}{10}$ miles, over a private road made by the contractor. The pit was pre-irrigated with twenty-five Rain-

maker sprinklers, using water pumped directly from the Yuma canal with a 4-inch Byron-Jackson pump.

Fourteen 8-yard Sterling trucks were used, loaded by a 2 $\frac{1}{2}$ -yard Northwest shovel, and traveling fast both ways. The dirt was spread in 6-inch layers with a LeTourneau bulldozer on a Caterpillar Seventy-Five, with a sheepsfoot roller pulled behind it. A McMillan scraper was used to good advantage on this job by attaching a sheepsfoot roller behind it with a special hitch. This consists of four triangular sections of 1-inch plate welded to the rear of the scraper and four similar plates welded to the front channel of the sheepsfoot frame. A long 1 $\frac{1}{2}$ -inch round bar, thrust through corresponding holes in these plates and fastened with a washer and cotter pin at the end, holds the roller to the scraper. The latter clips off any bumps and levels the earth ahead of the roller. The sheepsfoot are rebuilt from time to time by tacking a U of $\frac{1}{2}$ -inch mild steel rod to each one with a bead of Fleetweld 3/16 rod and then covering the whole with a coat of

(Continued on next page)

HELTZEL

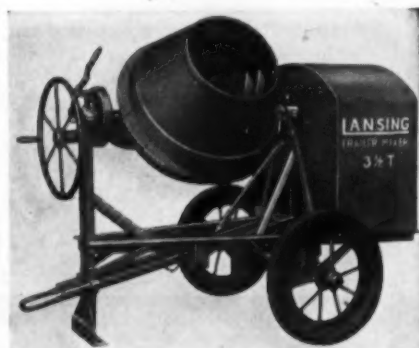
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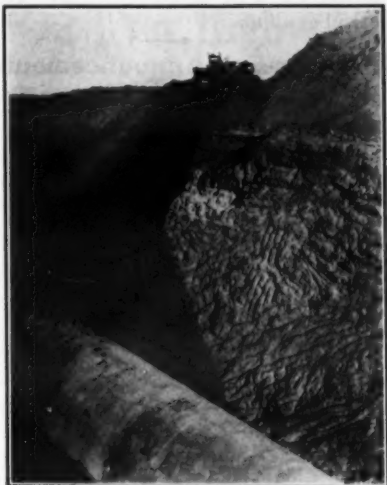
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A 57-Foot Rock Fill Near Riverside, Calif., Where the Griffith Co. Is Using a Caterpillar Diesel with Bulldozer to Bury the Huge Los Angeles Aqueduct Under a Fill Varying from 16 to 59 Feet for a Distance of 5 Miles

Slippery Roads Studied in England

Apparatus for accurately measuring the slipperiness of various types of road surfaces which has been developed at the Road Research Laboratory of the Department of Scientific and Industrial Research in England was described in a recent issue of *Public Roads*.

The machine used consists of a motorcycle and sidecar in which the sidecar wheel can be set at an angle to the direction of travel. The horizontal reaction of the road, developed by the wheel because of its position, and the load on the wheel are measured. From data obtained with instruments carried in the sidecar, the ratio of these forces is obtained and expressed as a coefficient which is high for non-skid roads and low for slippery ones. The construction and operation of the motorcycle and sidecar and of the measuring apparatus are described in Road Research Bulletin No. 1 recently issued jointly by the Department of Scientific and Industrial Research and the Ministry of Transport. The apparatus, which has been in regular use for several years, is estimated to cost £475, or about \$2,350.

Road Research Technical Paper No. 1 reporting the results of the first of a series of studies of road friction has also been published recently. This bulletin summarizes the results of numerous measurements made on various types of road surfaces under different climatic conditions and at different speeds.

The skidding coefficient was found to be high for dry road surfaces free from loose material, and such surfaces can be considered non-skid. On wet surfaces, the coefficient decreases as the speed increases. A value of 0.5 at 30 miles per hour may be regarded as reasonably safe; a value of 0.2 indicates that the surface affords insufficient resistance to skidding. Values of 0.2 or less are found most frequently on city streets. The most slippery condition of a road is probably during a slight thaw, when the coefficient is as low as 0.1 at all speeds. Measurements taken on a snow-covered road showed values ranging from 0.5 to 0.2, the latter being found after the road had become packed. The values for snow-covered roads were no lower than those found on some smooth wet surfaces but on snow-covered roads the lower values may persist down to speeds of 5 miles per hour.

On concrete surfaces the coefficient varied but little at different seasons of the year. Practically all other surfaces, when wet, were more slippery in summer than in winter. Tests made on wood

and rubber-block pavements showed them to have low coefficients.

The apparatus is now being improved to enable tests to be made at speeds higher than 30 miles per hour.

All-American Canal Nearing Completion

(Continued from preceding page)

Abrasoweld. As many as seven of these welds are brought up at a time, shifting from one to another to avoid excessive heating. Additional water needed on the fill was added from an 1,800-gallon tank mounted on a Mack truck. Eight feet 6 inches of uncompacted earth was placed on top of the fill with a Le-Tourneau Carryall, hauled by a Caterpillar Seventy-Five. The compacted material is 24 feet thick at the bottom, 18 feet 6 inches at the top and 21 feet 6 inches high.

Widening Pilot Knob Rock Cut

A small but spectacular job is the widening of the slopes of the west rock cut at Pilot Knob, contracted to the V. R. Dennis Construction Co. of San Diego, Calif. for \$32,500. Fifty thousand cubic feet of rock excavation is involved. The cut was originally dug by the Griffith Construction Co., but caving of the slopes later led to the decision to flatten them.

With safety lines attached, jack-hammer men are drilling the face of the slope to a depth of 15 to 30 feet with Gardner-Denver equipment, while a Cleveland wagon drill is used for 80-foot holes along the rim. The holes are sprung with 40 per cent Trojan stick powder, and loaded with bag powder of the same make. Compressed air is piped from a Schramm stationary compressor at the shop, driven by a 125-hp Westinghouse motor. Two Caterpillars, a 60-hp gasoline unit and a 75-hp diesel, with bulldozer attachments, crawl along the rim of the cut and push the loose material over the bank. Dropping to the canal bottom, it is loaded with a Lorain 75 into Koppel side-dump industrial railway cars, running on a double track through the cut. Empties are spotted by the Plymouth locomotive, but are moved along as they are loaded by resting the shovel dipper in a car and

pushing them ahead.

Personnel

R. B. Williams is Construction Engineer of the All-American Canal project for the U.S. Bureau of Reclamation. Grant Bloodgood is Resident Engineer for the canal. T. A. Clark is Office Engineer for the Bureau.

Major L. D. Crawford, Vice President of the W. E. Callahan Construction Co.,

is in charge of all of that firm's operations on the canal, with V. H. Gray, Construction Superintendent. C. A. Colin is Field Superintendent for Lewis-Chambers, Adolf Haidlen is Superintendent for the George Pollock Co., and Ray Terry is Superintendent for the Lewis Construction Co.

(The work of concreting on this All-American Canal project will be described in the July issue.)

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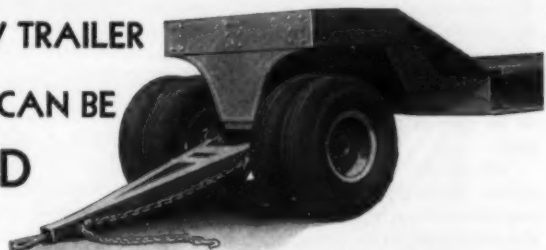
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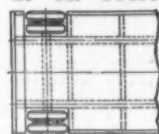
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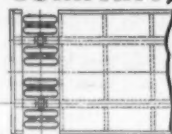


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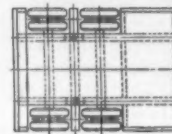
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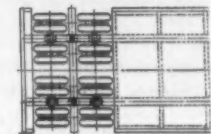
Single rear axle used on four wheel trailers mounted on single or dual tires.



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A Well-Planned File For Active Bridge Data

So that bridges won't be forgotten, the Ohio Department of Highways maintains a visible index that is both a complete and a compact record of every state bridge. Each structure is given a distinctive number, composed of three parts: 1, in general, the first two letters of the name of the county in which it is located; 2, the number of the route on which it is located; and 3, the distance of the structure in miles and tenths of a mile from the point of the beginning of the route in the county. For example; bridge number FR-40-216 would be in Franklin County on Route 40, and located 21.6 miles from the west county line. The decimal point is omitted in the bridge number in the file. A separate card 8 inches square with an index which is visible when the card is placed in the file is made for each structure of over 10-foot span. The bottom 1/4-inch of each bridge card is exposed to view and is so marked as to show at a glance the bridge number, county, route number, state highway number, strength of the structure, roadway width, vertical clearance, type of structure and approximate span. Special red signal tabs are also attached to the cards, marking structures which are outstandingly hazardous or in special need of replacement or repair.

The body of the card, using both sides, contains complete information concerning each structure such as the fundamental dimensions, size of principal members, a sketch of the structure and a sketch of any unusual features, together with a location sketch. An inspection report is also made and placed immediately under the card for each structure, giving its condition and stating any recommended replacements or repairs. Basic information as to all culverts located between any two bridges is compiled on a separate sheet which is filed between the cards for the respective bridges for the sake of compactness. No visible index is provided for these culvert cards. These cards are arranged upward in the same sequence as the structures occur on the highways. Where a route enters a county a separating card is provided, on which is sketched a map of the route through the county and which also gives the exact location of all junctions with other state highways, entrances and exits from the corporate limits of municipalities, all railroad crossings and any equation in mileage that may result from alterations of the highway after the original survey.

Various colored cards or sheets are used for various purposes and types of structure. Salmon cards are used for maps and to separate routes. White cards indicate structures built of concrete or stone. Steel truss bridges are designated on yellow cards. Buff indicates steel beam or girder bridges. Fawn-colored cards are used for timber bridges. Green was the color chosen to indicate railroad grade separation structures.

The field sheets on which field data are recorded are made of thin paper of the same color and have headings and items that are identical with those which are placed on the file card. This detail is of great importance to guarantee that no information is overlooked in the field which should be recorded in the permanent file.

This entire record system is prepared in duplicate, one record being kept in the central office covering the entire state, the other being kept in each of the twelve divisions throughout the state for the structures on the highways under the jurisdiction of the respective divisions.

While the cards are permanent so long as the identified structure remains in service, the inspection reports for each structure are intended to be filed



The Flynn Surgrader with the Overpass for Trucks

Subgrader Adaptable to Stabilization Mixing

Uniformly accurate and compact subgrade at high speed and low cost sounds good to any contractor. These are the manufacturer's claims for the Flynn Surgrader (pronounced Sure-grader), made by the Flynn Mfg. Co., Alexandria, La. Powered by a 6-cylinder 66-hp Wisconsin motor, the Surgrader travels under its own power on the road forms on crawler treads which spread the load over a wide area of road form to obtain positive traction without danger of overload. Subgrade cutting is done at any of three forward speeds ranging upwards to 14 feet a minute, the excess earth being carried beyond the form line on both sides of the road simultaneously through flight conveyors. Cutting is done by a high-speed revolving cutter operated in an overcutting manner and fitted with wear-resisting teeth which may be set to any contour of subgrade.

A truck-overpass, shown in the illustration, is provided where trucking is done on the grade, permitting the passage of trucks without any interference with the continual forward operation of the Surgrader. A wagon having a tiltable frame and full circle turn with tractor hitch is provided for transportation between jobs. The wagon can also be used generally for transporting finishing machines, bins and batches, forms, and other equipment on the job.

Because it can pulverize and mix to

annually as the field engineers working under the division offices make these inspections.

On the 12,200 miles comprising the present Ohio state highway system, there are 7,405 bridges having a span of more than 10 feet, and approximately 63,000 culverts. The total cost of the original filing installation was approximately \$40,000, averaging slightly over \$5.00 per bridge, including the eight or nine culverts, on an average, which are filed with it. A very complete description of the cabinets and method of using the file is contained in a pamphlet "Forgotten Bridges" by J. R. Burkey, Chief Engineer of Bridges, Department of Highways of Ohio, which may be secured gratis from the American Institute of Steel Construction, 200 Madison Ave., New York, N.Y.

exact depth and contour, the Surgrader may be used for either cushion or admixture treatment on subgrade treatment and stabilization work. When used for this purpose, the revolving cutter is lowered to the required depth below the forms and cutting, pulverizing and mixing are done at one operation.

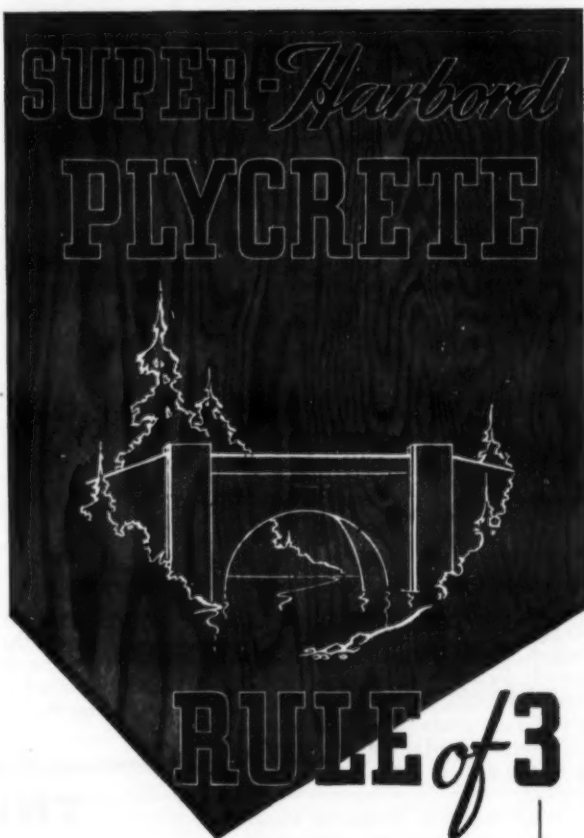
The Surgrader has been operated in

all sorts of soils, ranging from black sticky gumbo to hard rocky soils in fifteen states on well over 1,500 miles of subgrading.

Bucyrus-Erie Announcements

The Seattle office of the Bucyrus-Erie Co., of South Milwaukee, Wis., is now located at 3408 First Ave., So. Seattle, Wash. This company has also announced the appointment of the James W. Bell Co., Cedar Rapids, Iowa, as a new distributor. This company will cover the majority of the State of Iowa except for the extreme western area, and will carry the smaller machines in the B-E line as well as repair parts.

According to reports from the U. S. Bureau of Public Roads, the consumption of gasoline in the United States during 1936 amounted to 18,018,596,000 gallons, an increase of 10.8 per cent over the consumption in 1935. The total net income from gasoline state taxes amounted to \$691,420,000 as compared with \$619,677,000 in 1935.



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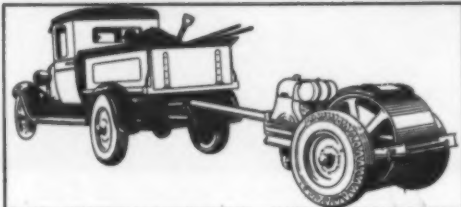
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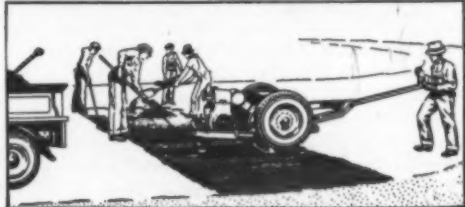


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Erosion Control On TVA Highways

(Continued from page 28)

tect cut slopes from run-off from adjacent land, care was taken to compute the expected volume of water and to make the ditch of ample size. Where the grade exceeded 1½ per cent, brush or rock paving was used to protect the bottom of the ditch. Care was taken at the outlet to keep the flow from berm ditches from causing additional erosion.

In the control of erosion on cuts and fills, all mechanical devices used were contrived with the idea of assisting in the establishment of a vegetative cover.

Planting

Planting undertaken on the steeper cuts has been disappointing, on the whole. Grass mixtures seeded with a protection of mulch and brush showed good growth during the first growing season but second year results have been poor. On flatter slopes, however, grass cover has become well-established by the end of the second season.

Approximately 30 per cent of the straw and brush mulch cover on the steeper slopes was destroyed by the end of the second growing season. Some of this destruction was due to stakes loosening when the earth into which they were driven became water soaked, or to the whole bank sliding. Another serious loss was destruction by fire. Fire gaps have been left in later work to prevent this form of loss.

On fill slopes of 1 on 1½, grass mixtures protected by straw and brush mulch have shown improved results at the end of the second growing season. Observations made on some fills on the Norris Freeway at the end of the third growing season show complete cover and stabilization.

Spot planting of honeysuckle on slopes up to 1 on 1 has been fairly successful on both clay and shale soils. A mulch and brush cover seems to have little effect on the establishment of honeysuckle although frost heave is diminished by this practice. Honeysuckle planted in rows shows about the same survival as spot planting. Best results have been obtained from sod strips of honeysuckle planted in contour furrows.

Some kudzu was planted in the spring of 1936 at the base of deep, mixed rock and earth cuts both in limestone and shale formations. We have approximately 25 per cent survival of the origi-



Wattles on a 1 on 1 Cut Slope on Highway No. 33 at Hickory Valley in Union County, Tenn. Complete Coverage of Straw and Brush Mulch in Foreground.

nal planting with the surviving plants showing a good growth for the first season.

Locust seedlings planted on fills showed remarkable results at the end of both first and second growing seasons.

Data sheets, giving the original characteristics, slope, exposure, soil, etc., of each 100-foot section where work was done, have been kept for primary roads. Any treatment was noted with dates and other information. A spring and autumn check-up of results has been initiated but insufficient time has elapsed for any positive conclusions to be reached.

The Norris Freeway has some 1 on 2 cut slopes on which Bermuda grass spot-planted with a light mulch has become well-established in a single growing season. Interception ditches were used to protect the longer slopes. The same treatment of 1 on 1½ fill slopes has brought even better results. On flatter cut and fill slopes grass, together with a variety of shrubs and trees, is on the whole in good condition at the end of two growing seasons.

Summary

Trends may be noted as follows: for the steeper cuts, honeysuckle or kudzu, if anything; for those less steep, Bermuda grass or a mixture of other grasses, shrubs, and trees; for high fills 1 on 1½ or 1 on 2 slopes, trees or Bermuda grass; for flatter and lesser fills, grasses, shrubs or trees or a combination of these, depending on individual locations, care being taken not to obstruct a driver's present or future view of the road.

From an erosion control point of view, any well-established vegetative cover will hold the soil. The choice of plant material for highways within the limits outlined above and those yet to be determined should be dictated from an aesthetic point of view.

Scraper Fills in Lakes And Moves Sand in Texas

An 8-mile grading and drainage project for the Sarita-Raymondsville road in Texas, connecting with Texas Highway No. 16, which was recently completed involved the excavation of about 100,000 cubic yards. The equipment on the job included a LeTourneau Model U 18-yard Carryall, an Austin-Western scraper, two Caterpillar graders, a Caterpillar elevating grader, and four Caterpillar RD-8 tractors.

At the start of the project, the Carryall worked on an average round trip of 2,250 feet, filling in three small lakes with fine sand. Completing a cycle in 9.1 minutes, it delivered 20 loads in 3 hours and 2 minutes. A few days later, working on an average round trip of 830 feet, the Carryall delivered 141 loads of blow sand and sandy clay in 17 hours and 45 minutes.

The contractor for this project was Standifer Brothers, of Big Wells, Texas,



Running Close to the Water's Edge in Making a Sand Fill on a Grading Job in Texas

for whom Alvin Coble was Superintendent.

News comes from Rome that press reports state that the new highway being constructed between Asmara, Eritrea, and Addis Ababa, Ethiopia, will be completed before the beginning of the next rainy season. There are reported to be 21,800 Italians and 8,450 natives engaged in the construction of this road.

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GOOD ROADS MACHINERY CORP.
KENNETT SQUARE, PA.

Grading New Road Location in N. M.

(Continued from page 5)

bined channel change and borrow pit with a Caterpillar 42-inch power-driven elevating grader loading to a Chevrolet truck and two International trucks owned by the company and a varying number of hired trucks. This outfit ran an 8-hour shift and moved from 1,500 to 2,000 yards in the one shift, depending on the number of turns required to keep within the bounds of the pit. Some time was lost when it was necessary to leave earth in one end of the borrow pit or channel change to "plate" a rock cut that had not been completed and for covering the rock fill made from this same cut. In this channel change a 60-foot steel bridge was constructed.

At the other end of the same balance the contractor had a Northwest 1½-yard shovel powered with a Twin City gas engine loading earth to five 3 to 5-yard White trucks and two 6-yard Internationals. The traffic handling of the trucks in this cut was responsible for the speed with which the shovel was able to deliver its yardage. The foreman sent one or two trucks back to the shovel directly as there was just about room to maneuver them but with one truck loading and a second ready to back in as soon as the first moved out, the way was blocked for the other trucks as they returned from end-dumping on the rock fill. Then it was that the foreman sent the next truck or two over the hill where they had to negotiate a grade of about 25 per cent. This enabled the trucks to get behind the shovel and drive up without slowing up the loaded truck or the one in front that could back to the shovel in some sections of the cut where it had been widened to its full width. The cut was 25 feet deep where this was done.

For speedy handling of the pouring of culverts Nate Skousen used a 2-bag Jaeger mixer mounted on a Chevrolet truck with the skip rails extended to ground level.

Quantities

The major quantities on these contracts were as follows:

Item	Quantities
WPCB 27 Roadway	
Clearing and grubbing.....	4.8 acres
Excavation, unclassified.....	115,924 cubic yards
Excavation, structures.....	915 cubic yards
Excavation, pipe culverts.....	160 cubic yards
Pit-run material.....	8,975 cubic yards
Overhaul.....	135,346 station-yards
Haul.....	13,101 ¼-mile-yards
2-course surfacing.....	34,511 tons
Class A concrete, box culvert and siphons.....	798 cubic yards
Class B concrete, corrugated metal culvert headwalls.....	42 cubic yards
Reinforcing steel.....	170,443 pounds
24-inch corrugated metal pipe.....	396 feet
30-inch corrugated metal pipe.....	114 feet
36-inch corrugated metal pipe.....	152 feet
Lengths of projects.....	5.465 miles
Bridges	
Excavation for structures.....	1,246 cubic yards
Class A concrete, substructure.....	433 cubic yards
Class A concrete, superstructure.....	101 cubic yards
Untreated lumber, substructure.....	8,244 MMB
Structural steel.....	95,445 pounds
FAP 75 and 27 Reopened	
Clearing and grubbing.....	110.4 acres
Excavation, unclassified.....	220,274 cubic yards
Excavation, structures.....	2,646 cubic yards
Excavation, pipe culverts.....	701 cubic yards
Overhaul.....	426,794 station-yards
Haul.....	30,376 ¼-mile-yards
2-course surfacing.....	72,312 tons
Class A concrete, box culvert and siphons.....	2,051 cubic yards
Class B concrete, corrugated metal culvert headwalls.....	94 cubic yards
Reinforcing steel.....	314,380 pounds
24-inch corrugated metal pipe.....	830 feet
30-inch corrugated metal pipe.....	474 feet
36-inch corrugated metal pipe.....	438 feet
Lengths of projects.....	6.821 miles
Bridges	
Excavation for structures.....	620 cubic yards
Class A concrete, substructure.....	235 cubic yards
Class A concrete, superstructure.....	50 cubic yards
Untreated lumber, substructure.....	8,192 MMB
Structural steel.....	63,064 pounds

Personnel

Skousen Bros., of Albuquerque, N. M., the contractor for this long grading project, consists of the three brothers named at the beginning of this description of their work. They act as their own superintendents. For the New



C. & E. M. Photo

Gordon Sumner, State Manager for the N. M. State Highway Dept. Planning Survey, Standing in a 12-Foot Arroyo on the Skousen Contract

Mexico State Highway Department the work was in charge of Gordon Sumner, then District Engineer, with C. H. Muchmore and Marshall Wylie as Project Engineers.

More Roads for South China

As a result of the rather intensive highway construction program carried on in South China during the past few years, there are now approximately 7,000 miles of roads in Kwangsi and 9,740 miles in Kwangtung Provinces. During 1936, 400 miles of new highway was built in Kwangtung at a cost of \$1,270,000, according to a report from the U. S. Bureau of Foreign and Domestic Commerce. The Kwangtung Pro-

vincial Government has announced a highway construction program for 1937 which provides for building 701 miles of provincial highways and 325 miles of country roads.

Catalog on Breakers and Reduction Crushers

A new bulletin No. 261-K featuring Telsmith primary breakers and reduction crushers has just been published by the Smith Engineering Works. The features of the gyratory crushers for primary crushing are described and illustrated, as are also the features of the secondary crushers for reduction.

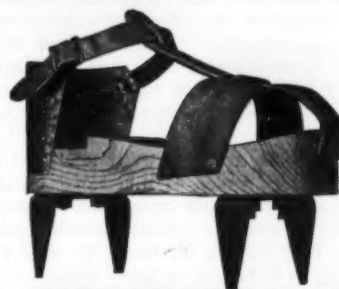
Copies of this new bulletin may be secured gratis by writing direct to the Smith Engineering Works, 4014 N. Holton St., Milwaukee, Wis.

Trench-Hoe Attachment For Line of Truck Shovels

A trench-hoe attachment for Quick-Way truck shovels has recently been announced by the Quick-Way Truck Shovel Co., of Denver, Colo. After several months of experimental operation, the manufacturer claims that this new attachment has been thoroughly tested on every kind of trench-hoe job in all types of materials, and that because of the mobility of the Quick-Way unit, the new trench-hoe attachment operates with unusual efficiency.

Complete information on this new attachment, as well as on Quick-Way truck shovels, may be secured direct from the manufacturer by mentioning this magazine.

NEW! DAVENPORT PAVER'S SANDAL LEAVES NO FOOTPRINTS.....



THIS new Davenport Wood Sole Shoe is ideal for asphalt workers. No shoe impression is left in the asphalt because the 3-inch spikes contact the concrete road base. The spiked prongs are securely fastened to flat-cut soles with two counter sunk bolts and lock washers. Recessed heels and curved soles give comfortable fit over regular shoes. Regular Paver's Sandals without spikes also available with curved sole, galvanized iron counter and adjustable in-step strap. Orders filled same day received. Low quantity prices!

FREE GUIDE Write today for Davenport Wood Sole Shoe Manual—your guide to economical foot protection for employees.

F. J. STAHLER SHOE COMPANY, Davenport, Iowa
World's Largest Exclusive Manufacturers of Wood Sole Footwear

ONE OF THE BIGGEST-EQUIPPED WITH PNEUMATIC TIRES

This Rogers Trailer, recently shipped into Los Angeles, is about the largest capacity trailer made, equipped with pneumatic tires. The REAR GEARS under the trailer consist of 8 wheels on 4 rock axles, each wheel equipped with dual 9.75x15 14-ply tires. The front gear, or dolly, for this trailer is a small semi-trailer and the rear gear of this consist of 4 wheels on 2 rock axles, each wheel equipped with one 13.50x24 16-ply tire.

ROGERS BROS. CORPORATION
Albion Penna.

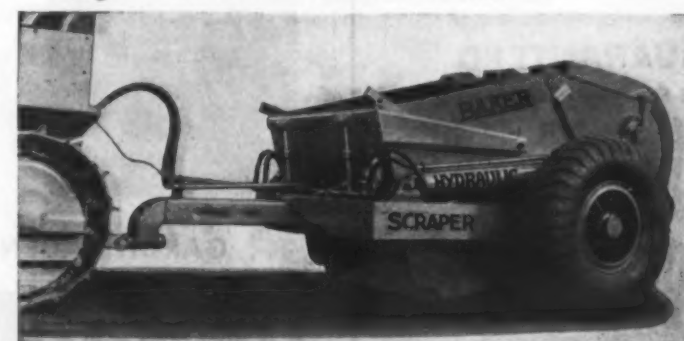


The deck of this trailer is 11' wide, 18' from back of the gooseneck to front of rear wheels, loading height at the rear 35", loading height of deck 29" (without load), over all length of this trailer (as a semi-trailer) 35' 6", overall length of complete trailer with semi-trailer-dolly 47' 9".

There's a ROGERS to fit every TRAILER need. Sizes: from 5-100 tons.

Announcing the BAKER HYDRAULIC SCRAPER

The pioneer builders of tractor scrapers now offer hydraulic models in 5 cu. yd. capacity, nearly 25 per cent lighter than scrapers of like capacity (because of the use of Hi-Steel). They have less draft and even greater strength. A 35 to 40 H.P. tractor handles them.



Light Weight—Great Strength—Easy Loading—Clean Dumping—More Yardage To The Dump

Accurate control by the tractor driver, down pressure for tough soils, and novel adjustments make the Model 180 an outstanding scraper for 35 to 40 H.P. tractors.

Ask for Bulletin No. 591

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Longitudinal Brick Experiment in Ohio

Conclusions Drawn from 1.35-Mile Project Laid During Late Fall Under Trying Conditions

By **BOYD V. WRIGHT**,
Resident Engineer, Ohio State Highway Department

TRAFFIC on Ohio Route 31, Hocking County, Ohio, is very heavy, probably the third most heavily traveled road in the state, and consists of about 50 per cent trucks which are heavily loaded with brick, sewer pipe, pottery and merchandise. For this reason, a good hard-surfaced pavement is necessary. Last year, the Ohio State Highway Department constructed an experimental brick pavement as a Federal-Aid project on this route.

The alignment contained a 2-degree curve, 1,083 feet in length, with a maximum super-elevation of 0.84 foot and no extra widening; an 18-minute curve, 2,628 feet long, neither super-elevated nor widened; and a 1-degree 45-minute curve with a maximum super-elevation of 0.64 foot and no extra widening. The total length of the job was 1.35 miles.

Concrete Base Course

The base course consisted of reinforced concrete of 7-inch uniform thickness 20 feet wide, with 9 x 3 1/2-inch integral concrete curbs. The mix for the base course was 1:7 1/2 and for the curbs, 1:5 1/2. Contraction joints were constructed of continuous premoulded joint material.

The pouring of the base course started on October 22, 1936 and was finished on November 20. Although compaction tests were made on all fills and great care was used in keeping the subgrade in shape, the base course was not laid under ideal conditions, due to the weather, the time of the year and the fact that the Department was very anxious to complete the road and open it to traffic.

Mastic Cushion

The mastic cushion was composed of manufactured limestone sand and cut-back asphalt, mixed in proportions of 92.5 to 95.8 per cent fine aggregate by weight, and from 4.2 per cent to 7.5 per cent cut-back asphalt by weight. Ohio state specifications provide a variation of from 4 to 7 per cent by weight in the bituminous content of mastic cushion. The cushion was prepared by the Marble Cliff Quarries Co., at Columbus, Ohio, mixed at its plant and trucked to the job. As the work extended from the middle of November to about the middle of December, some difficulties were encountered in the use of the mastic cushion because of the air temperature which ranged from 13 degrees to 54 degrees F. above zero.

The temperature of the cushion, as delivered on the job, ranged from 54 to 110 degrees F. Experience showed that when the temperature of the cushion fell below 60 degrees it was too stiff to flow freely under the strike-off template, and had a tendency to ball up and drag free of the base. After one or two truckloads, no further attempt was made to lay the cushion if its temperature was below 60 degrees when delivered to the job.

The greatest difficulty we had in the use of the mastic cushion was to keep the bed maker and contractor's employees from stepping on it. When this happens, the mastic cushion is compacted by the weight of the person and acts the same as if a stone were placed in the cushion, causing high spots in the pavement which have to be removed.

Brick Paving

The brick surface course consisted of vertical fiber lug brick, 3 x 4 x 8 1/2 inches, laid with the 3-inch face vertical on the 3/4-inch mastic cushion. The width of the brick pavement between curbs was 18 1/2 feet. This brick surface course was the experimental part of the job, in that the bricks were laid longitudinally or with the long dimension of the brick parallel with the center line of the road, instead of the usual method of laying them transversely or with the long dimension of the brick at right angles to the center line.

Laying brick was started at the south end of the job on a 1-degree 45-minute curve, super-elevated 0.64 foot, but not widened. The bricks were hacked for the first 100 feet on the high side of the curve, so they started to lay from that side. We were able to lay 54 courses of brick, for the 18 1/2-foot width, with but very little spacing or shifting of the brick. At first we tried to lay the brick by carrying the laying face parallel with the curb and four bricks wide, but this was soon abandoned because of the "pigeon holes" or dove tailing of every other brick which slowed up the operation. Then we started to carrying the laying face diagonally across the road, or at about a 45-degree angle to the curb. This method proved more satisfactory and much faster.

We used every method we could think of to develop speed in laying the brick. We laid from both sides toward the middle, but discarded this method as unsatisfactory. We tried having the brick delivered to the droppers on rollers and abandoned that. Then we had them carried over to the droppers by men using tongs. This method we used for the greater part of the job. We found that a longitudinal brick job could be laid at a much faster rate than a transverse brick job, because the number of brick droppers that can be employed is limited only by the contractor's equipment and ability to keep up with the rolling of the brick and the application and removal of the filler.

Rolling and Filling

Rolling was done with a 5-ton tandem roller, moving parallel with the center line of the road. The pavement was carefully straight-edged after the rolling and upon completion showed only one bump over that allowed by the specifications, or 1/4-inch in 10 feet.

Standard asphalt was used for the joint filler and because of the cold weather was heated to 460 degrees F. or more before being applied to the brick. The bricks were also heated.

Conclusions

From this experiment we have concluded:

1. That brick should never be shifted or spaced. Once laid on the cushion, they should not be disturbed, except by the roller, or to be lifted out vertically, to be turned or replaced; that laying should be started at one curb and the bricks laid as snug as possible. If the courses of brick do not come out even, bat in the remaining space.
2. That as long as the brick vary in size as much as they do now, it is impractical to try to get straight courses and still maintain the ultimate in good riding qualities.
3. That it is unfair to the contractor and to the experiment in progress to

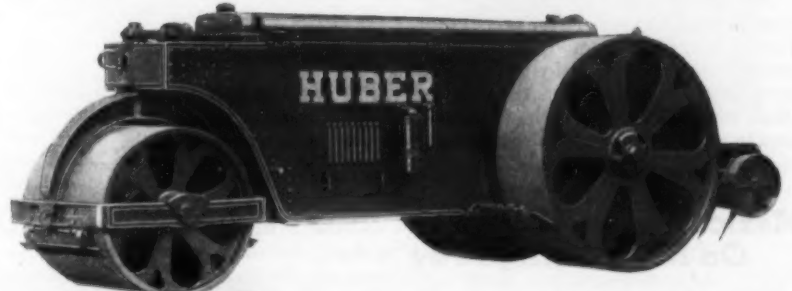


A 148-Inch Wheelbase Autocar with a DeLuxe Cab and a Gar Wood 13-Cubic Yard Dump Body Mounted on a Fruehauf Trailer

construct it under a unit-price form of contract. Better results, less gray hair, and only about 40 per cent of the bad feeling would result if a cost-plus form of contract was adopted for the experimental parts of road contracts.

From a paper presented before the Thirty-First Annual Meeting of the National Paving Brick Association.

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Above is a typical maintenance scene. North Carolina State Highway Department crew using Littleford No. 78-OB heater, equipped with Littleford Motor Spray Attachment.



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One of the Gar Wood Scrapers in Which a Reduction in Weight Has Been Accomplished by the Use of Yolo. An Allis-Chalmers Tractor Is Providing the Power.

Reduction in Weight Of Hydraulic Scrapers

Reduction in weight plus increased durability and strength in its 10-yard hydraulically-operated scraper has been announced by Gar Wood Industries, Inc., Road Machinery Div., Detroit, Mich. The weight of this unit, which has a hauling wheelbase 13 feet 9 inches long, was reduced from 18,500 to 13,500 pounds, equivalent to 2 cubic yards of pay dirt. Equipped with heavy-duty hydraulic hoists, the Gar Wood scraper can dig, haul and spread over 800 yards of dirt in an 8-hour day on average haul.

This 5,000-pound 27 per cent reduction in weight resulted from the use of Yolo, a nickel copper high-tensile-strength steel produced by the Youngstown Sheet & Tube Co., of Youngstown, Ohio, which is claimed to have a resistance to atmospheric corrosion from four to six times that of ordinary carbon steel.

Mexico Rushes Work On Nogales Highway

Owing to the increased influx of tourists from the United States, particularly over the recently-completed Laredo-Mexico City highway, efforts are being made by the Mexican Government, with State cooperation, to rush the completion of an additional highway through the western part of the country from Nogales via Guadalajara, to Mexico City, according to a recent report from the U. S. Bureau of Foreign and Domestic Commerce. The approximate length of this highway will be 1,615 miles. Construction will be carried on in sections with the cooperation of the States of Jalisco, Nayarit, Sinaloa and

Sonora, through which the highway will run.

During 1937 special attention will be given to the construction of the section from Nogales to Guadalajara and about \$1,110,000 will be spent this year. The greater part of this amount will be used to eliminate one of the major obstacles, about 10 miles of mountain area bordering the States of Jalisco and Nayarit. This will be virtually all new construction and is the most difficult problem facing the engineers. The rest of the budgeted 4,000,000 pesos will be used to condition other sections of the route already open. The total cost of the road from Nogales to Guadalajara is estimated at about 60,000,000 pesos or about \$16,650,000.

The road will be of the secondary type, the material to be used being obtained in the surrounding region and the road surface for the most part comprised of crude petroleum mixed with gravel. This route will be financed co-operatively by the Central Government and the States through which the road passes, the states to contribute 50 per cent of the initial cost. In addition, they will contribute toward the maintenance of the road 50 per cent of the increased income from gasoline taxes received by them as the result of opening the road.

The total cost of the Guadalajara-Mexico City section of the road is estimated at 22,000,000 pesos (\$6,105,000), of which 15,000,000 pesos has already been expended. The road will be of bituminous concrete and it is expected that it will be open for tourist traffic by the end of 1938.

The Secretariat of Communications has announced that in addition to the above construction, improvements will

be made on the Mexico City-Acapulco highway to facilitate the continually increasing use of this route by tourists.

Preparing Old Concrete For Repaving in Ohio

(Continued from page 26)

with mesh laid from the edges up to the center joint from either side, on top of the side bars, and shear bars which were laid $2\frac{1}{4}$ inches below the top of the base slab. Reinforcing bars $\frac{1}{2}$ -inch diameter and 5 feet long were laid across the center joint at intervals of 5 feet. Shear bars $\frac{1}{2}$ -inch in diameter and 2 feet long were laid at the edge of the old slab at 2-foot intervals and with half of each bar in the widening strip.

Water for the concrete was supplied through a 2-inch pipe laid along the ditch. A Barnes triplex pump on the bank of Scioto River near the southern end of the contract furnished the pres-

sure. Brick for the final surfacing was supplied by the Peoples Brick Co. of Portsmouth, Ohio.

Working Hours

The contract for this project allowed 70 working days which were not required by the contractor to finish the work. The job was run with local labor working 40 hours a week. Two 6-hour shifts were used each day for six days a week, allowing 4 hours of extra work for each man when needed.

Personnel

W. H. Ringwald & Sons of Chillicothe is a partnership formed in 1898 and is now continued by W. E. and E. B. Ringwald who have been in the organization since 1906. On this contract the work was in charge of Floyd Jacobs as Superintendent. For the Ohio Department of Highways, John J. Jaster, Jr., Director, the work was in charge of J. W. Alanivia, Resident Engineer, A. L. McFarland, Project Engineer, and G. C. McConnell, Chief Inspector.



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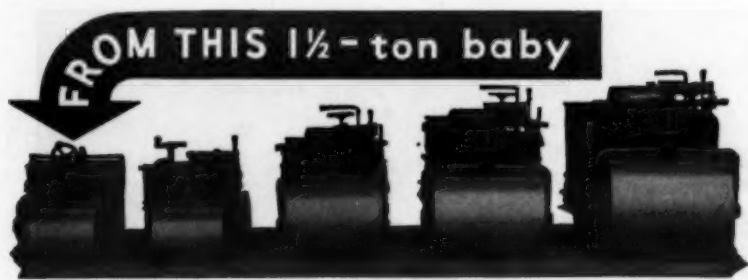
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TO THIS 18-ton giant roller

Experimental Binder For Oregon Jetty

(Continued from page 40)

a surface slope approximating that of the enrockment, $1\frac{1}{2}$ to 1, or possibly a little steeper.

The work was carried on under a two-shift operation in the daylight hours, at an average rate of approximately 400 tons per working day. The best daily record was 650 tons. During the period August 5 to September 11, 1936, the total weight of asphaltic mix placed was 12,787 tons.

Quantities and Costs

From the records of the quantity placed in the truncated pyramidal section at the end of the jetty and assuming that voids in the stone amount to 35 per cent of the total volume, it is estimated that the asphaltic mix penetrated, on an average, to a plane about 1 foot above mean lower low water and about 3.2 feet below mean sea level. The combined weight of the stone and asphaltic binder in the terminal structure, including only the fully impregnated section about 150 feet in length at the outer end, and above low water, is estimated at 30,000 tons.

The field cost of the work, including supervision, amounted to \$87,490, divided in general as follows:

Asphalt delivered at the job (2,020.39 tons).....	\$40,160
Plant rentals, miscellaneous materials and supplies..	24,530
Labor, mixing and placing.....	14,020
Plant mobilization, erection and demobilization.....	8,980
Total for 12,787 tons of mix.....	\$87,490

Sand cost nothing except for handling charges included above.

The work was done by the First Portland, Oregon, Engineer District, under the direction of Lieut. Col. Milo P. Fox, District Engineer. O. J. Hawkins, Assistant Engineer, was in charge of field operations.

Effect of Winter Storms

Since the work was completed in September, there have been several severe storms throughout the winter season. The effects of these have been observed with interest, and it is found that very material damage has been done above low water level. The south slope and the outer end have been steepened to practically vertical faces, the extent of the erosion amounting to perhaps 50 per cent of the volume of the superstructure. As previously stated, it was realized at the time of construction that the south slope along the water lines was the weakest part of the structure. This is also the point at which the action of the heavy seas is most destructive.

Such inspections as have been made this spring indicate that while the as-

phalt mastic penetrated well into the voids and small crevices down to near low water level, the material in passing through the large body of cold wet stone and on reaching the water was transformed into a brittle crumbly mass with little strength or adhesive quality. The pounding, surging action of the sea apparently removes this material very quickly and the unbound stone in the lower levels is then easily washed out. When this happens, the overhanging mass of stone and asphalt which is more firmly bound together breaks off from the face in comparatively large sections under its own weight. The ultimate destruction of the terminal is therefore only a question of time.

It should be realized that this work was done in an effort to find a satisfactory means of stopping the end raveling of the jetty enrockment above low water level. It was placed only on the end of the jetty for a distance of about 300 feet, while the total length of the

jetty from the beach is over 3 miles. The main body of the structure has not been materially affected by the storms of several winters.

It is possible that better results would have been secured if the superstructure had been built up in lifts of 5 or 6 feet instead of pouring the asphaltic mix through the full height of the enrockment. It appears doubtful, however, that even then sufficient bonding of the cold wet stone in the lower course could be secured to prevent its removal by the sea.

Wayne County's Attitude Toward Highway Safety

Safe driving depends upon the car, the driver, and the road or track upon which he travels. With all-steel bodies, nearly perfect brakes, safety glass and other improvements, the manufacturers have taken a long step forward to pro-

vide the safe car. As to the driver, it is a matter of education.

There remains the problem of the safe road. Even if safety was embodied in the road built ten or fifteen years ago, many new factors have changed the problem with the times. Increased speeds must be taken care of by providing smooth surfaces, super-elevated curves and refinements which will insure greater sight distances. Warning signs at dangerous points must be provided, as well as the elimination of grade crossings, illumination, traffic signals and wide shoulders for parking off the traveled track. These are only a few of the many problems encountered, as seen by the Board of County Road Commissioners of Wayne County, Mich., and in the opinion of this group of pioneers in the field of road construction, as expressed in their Thirtieth Annual Report, they will not have taken care of their end of highway safety until these problems are satisfactorily solved.

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Bulletins and Pamphlets

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Increasing Capacity of Light Trucks

192 The Thornton Four Rear Wheel Drive which, when built into a light truck, creates a powerful, economical heavy-duty unit is described in pamphlets, one for its use on Ford trucks and one for Chevrolets, which may be secured upon request from the Thornton Tandem Co., 5155 Braden St., Detroit, Mich.

Giant Catalog on Road Equipment

193 Copies of the Jaeger Giant Catalog, describing and illustrating the Jaeger line of pumps, wellpoint systems, concrete mixers and placing equipment, concrete and bituminous spreaders and finishers, truck mixers, bituminous pavers and other road-building equipment, may be secured direct from the Jaeger Machine Co., 701 Dublin Ave., Columbus, Ohio.

Features of Crawler Tractors

194 The controlled differential steering which gives full traction and power on both tracks when turning and the other features of Cletrac crawler tractors are described in literature which the Cleveland Tractor Co., Cleveland, Ohio, will send on request.

Wagon Drills for Rock Cuts

195 Cleveland wagon drills for drilling in rock cuts and which are adaptable and easy to handle, are described in Bulletins 109 and 111 which may be secured by those interested direct from the Cleveland Rock Drill Co., 3734 E. 78th St., Cleveland, Ohio.

Tires for Heavy-Duty Service

196 Details and prices on Goodrich Silver-town tires, which are triple-protected against blow-outs, may be secured by interested contractors, and state and county highway engineers from the B. F. Goodrich Co., Akron, Ohio.

Form Clamps

197 Complete information on Williams form clamps with which the spacing of the forms is done merely by driving a nail in the stud may be secured by interested contractors and engineers from the Williams Form Engineering Corp., 1244 Prospect Ave., S.E., Grand Rapids, Mich.

New Catalog on Road Joints

198 Crosslode expansion joints and Translode joints, which are claimed to be rigid and foolproof, requiring no dowel bars, are described in the new catalog and manual which contractors, state and county highway engineers may secure gratis from the Highway Steel Products Co., Chicago Heights, Ill.

Complete Line of Road Machinery

199 The Gar Wood line of road machinery, including dump bodies, hoists, hydraulic scrapers, road rippers, bulldozers and sheepfoot rollers, is described in literature which the Gar Wood Industries, Inc., Road Machinery Div., Detroit, Mich., will be glad to send on request.

Lubricants for Diesel Engines

200 Complete information on Sinclair Tenol, Sinclair diesel fuels and other products, which were especially developed for diesel service may be secured by those interested from the Sinclair Refining Co., Inc., 630 Fifth Ave., New York City.

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prices on _____

Wagon Scraper Back-Dumps Like Truck

201 Continental Roll & Steel Foundry Co., Railroad Ave., East Chicago, Ind., will be glad to send to those interested complete information on its Continental wagon scrapers, an exclusive feature of which is that they back-dump like a truck.

Single and Two-Line Puller Jacks

202 Complete information on Anchor Puller Jacks, with a single-line capacity of 3 tons and a two-line capacity of 5 tons, which come in handy in dozens of ways on construction jobs, may be secured from the Edelblute Mfg. Co., Reynoldsville, Penna.

A New 1/2-Yard Shovel

203 Complete information on the new Buckeye Model 50 Clipper, a modern full-revolving, fully convertible 1/2-yard excavator, may be secured by those interested direct from the Buckeye Traction Ditcher Co., Findlay, Ohio.

Features of 3/4-Yard Shovel

204 One of the features of the Northwest 3/4-yard shovel, made by the Northwest Engineering Co., 1727 Steger Bldg., 28 E. Jackson Blvd., Chicago, Ill., is its sturdy one-piece alloy steel casting designed for heavy duty and long life. This and the other features of this shovel are described in literature which may be secured direct from the manufacturer.

Vibrators for Concrete and Asphalt

205 Munsell air-operated vibrators for all classes of concrete construction, portable vibrating screed boards for highway pavements, and special steam-operated vibrators for placing hot asphalt mixtures are described in circulars which may be secured from Munsell Concrete Vibrators, 997 West Side Ave., Jersey City, N.J.

Solving Metal Problems

206 An interesting 48-page book has been prepared by the International Nickel Co., Inc., 67 Wall Street, New York, which should be in the hands of every engineer who is interested in the solution of corrosion problems in the sanitary and structural fields. It is a guide book to Monel and other non-ferrous nickel alloys in the fields of engineering applications.

A 1 1/4-Yard Aggregate Loader

207 The N. P. Nelson Iron Works, Inc., Passaic, N. J., will be glad to send to those interested complete information on the Nelson K-4 loader which has a capacity of 1 1/4 yards and a 9 1/2-foot discharge.

Improved Woodworking Tools

208 Power King woodworking tools, including planers and joiners, saws of various types, lathes, bench grinders and accessories, are described in a new catalog, No. 107, which the Power King Tool Corp., Warsaw, Ind., will be glad to send on request.

New Note in Crawler Crane Design

209 The new design of Lima crawler cranes, which makes possible swing, hoist, travel, and moving the boom up or down at the same time, is described in Bulletin No. 3 which the Lima Locomotive Works, Inc., Shovel & Crane Div., Lima, Ohio, will be glad to send on request.

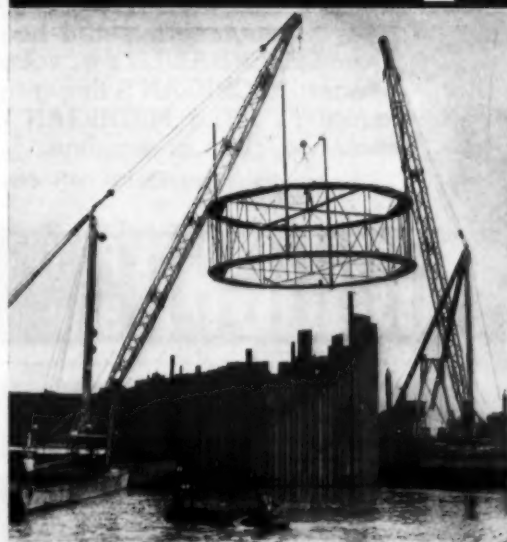
Wheelbarrows with Pneumatic Tires

210 Features of Lansing pneumatic-tired wheelbarrows which are light in weight and easily handled are described in Bulletin L-12 which may be secured from the Lansing Co., Lansing, Mich.

WILLIAMSPORT

"Form-Set"

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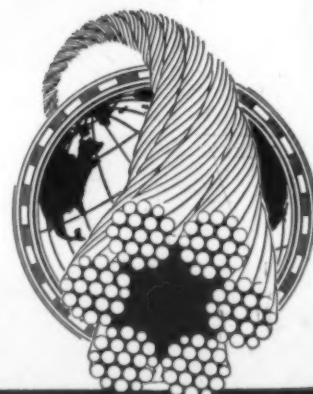
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WILLIAMSPORT, PENNA. Other Offices in Principal Cities 122 S. MICHIGAN AVE., CHICAGO

Bulletins and Pamphlets

(Continued from preceding page)

Catalog on Tilting Mixers

211 The complete story of Smith tilting mixers, some of which were used in the construction of Boulder Dam, Tygart Dam, Norris Dam, and others, a feature of which is the easy rolling mixing action, is contained in Catalog No. 160 which the T. L. Smith Co., 2857 N. 32nd St., Milwaukee, Wis., will send on request.

A New Highway Spreader

212 The Benedict highway spreader which, attached to a truck, spreads sand from 10 to 30 feet in width at from 12 to 20 miles an hour, is described in literature which contractors, state and county highway engineers may secure from the Benedict Mfg. Co., Big Rapids, Mich.

Complete Line of Road Rollers

213 The Buffalo-Springfield Roller Co., Springfield, Ohio, which has been manufacturing road rollers for 46 years, will be glad to send to those interested complete information on its line of rollers, in three-wheel, three-axle and tandem models in a variety of sizes.

Distributor with Non-Drip Spray Bar

214 Etnyre bituminous distributors, a feature of which is the non-drip circulating spray bar which prevents dribbling of the bituminous material after the shut-off, are described and illustrated in a new catalog, No. 506-B, which may be secured without obligation from E. D. Etnyre & Co., Oregon, Ill.

Hydraulic Dump Units of All Types

215 Complete information on the Heil line of hydraulic dump units which includes units of all types for all kinds of jobs and makes and sizes of trucks, may be secured direct from the Heil Co., 3000 W. Montana St., Milwaukee, Wis.

Complete Line of Pumps

216 The complete line of Rex Speed-Prime pumps, ranging from 2 to 8-inch in size, and with completely automatic priming, is described in the 1937 Rex Speed-Prime Pump Bulletin which the Chain Belt Co., 1666 W. Bruce St., Milwaukee, Wis., will be glad to send on request.

A Combined Straight-Edge and Scraper

217 L & M Manufacturing Co., 10302 Berea Road, Cleveland, Ohio, will be glad to send to those interested complete information on the GiantgripT combined straight-edge and scraper which has two usable edges, one rounded for line point straight-edging and one a squared sharp-cornered edge for scraping.

Graders With Eight-Wheel Drive

218 Complete information on the Warco Model 35 motor grader with the Warco 8-wheel Octopus drive may be secured by interested contractors, state and county highway engineers from the W. A. Riddell Corp., Bucyrus, Ohio.

Fast-Digging Buckets

219 Literature describing Williams fast-digging multiple-rope buckets, which have a double hinge allowing for a longer spread of the open bucket as well as making for rigidity, digging power and speed, may be secured by those interested direct from the Wellman Engineering Co., 7012 Central Ave., Cleveland, Ohio.

Self-Cleaning 4-Inch Pumps

220 Marlow Pumps, Ridgewood, N. J., will be glad to send to those interested complete information on the Marlow high-capacity self-cleaning high-suction-lift 4-inch pump, which is self-priming, has an open trash-type impeller, 4-cylinder engine and is spring mounted.

Self-Powered Road Sweeper

221 The Frank G. Hough Co., 919 N. Michigan Ave., Chicago, Ill., will be glad to send to interested contractors, state and county highway engineers complete information on the Hough-Universal road sweeper, a self-powered unit for preparing road grades for surfacing, fleets of which have been used by 27 state highway departments and over 75 bituminous contractors.

Labor-Saving Electric Tools

222 Syntrol electric tools, including hammers for drilling and cutting concrete, heavy-duty saws for cutting lumber, brick, etc., heavy-duty drills for rough service, and vibrators for settling concrete, are described in the 1937 Tool Catalog which Syntrol Co., 640 Lexington Ave., Pittsburgh, Pa., will send on request.

Buckets for Digging and Rehandling

223 The Hayward Co., 32-36 Dey St., New York City, will be glad to send to those interested, copies of its Bulletin O-266-A describing Hayward clamshell, orange peel, dragline and drag scraper buckets for every kind of digging and rehandling work.

Welded Carbody for Excavators

224 The P & H carbody and crawler frame welded into one rigid unit, as well as the other features of the P & H Pacemaker excavators, are described in literature which Harnischfeger Corp., 4419 W. National Ave., Milwaukee, Wis., will be glad to send on request.

Detachable Bits for Drills

225 Jackbits, made by the Ingersoll-Rand Co., 11 Broadway, New York City, in all types and sizes to meet varying drilling requirements, are described and illustrated in a new booklet entitled "Drill More at Less Cost" which the manufacturer will be glad to send on request.

Motorized Wheel Rollers

226 Complete information on the Model 135 Wheeled Roller, which is taken to and from the job as a high-speed trailer and on the job operates as a self-propelled roller, and which is an economical and efficient unit for all types of patching and miscellaneous jobs, may be secured from the Wheeled Roller Corp., San Antonio, Texas.

New Booklet on Locomotive Cranes

227 Bulletin No. LB-2, describing and illustrating American locomotive cranes in gasoline and diesel-powered models of various sizes to meet the requirements of the job, may be secured by those interested direct from the American Hoist & Derrick Co., St. Paul, Minn.

Power for Construction Jobs

228 Complete information on Caterpillar diesel engines, which can furnish all the power needed on the job, for tractors, road machinery, and excavating equipment, may be secured by interested contractors, state and county highway engineers direct from the Caterpillar Tractor Co., Peoria, Ill.

Portable Crushing Equipment

229 Gruendler crushing equipment, including its two-in-one hammer crusher, all-steel trailer-type jaw crusher, straight-line crushing and screening plant and a complete portable rock crushing plant, is described in Bulletin No. 500 which the Gruendler Crusher & Pulverizer Co., St. Louis, Mo., will be glad to send on request.

A Complete Line of Graders

230 Adams motor graders, of which there is one for every grading need, for light blading, for maintenance and road-mix work, and for heavy scarifying, oil-mix, and construction, are described and illustrated in literature which the J. D. Adams Co., Indianapolis, Ind., will be glad to send on request.

New Type of Pump Strainers

231 Rife square strainers with extended inner tubes, a new type of strainer for use on self-priming pumps for draining construction pits or manholes, are described in literature which may be secured by those interested direct from the Rife Hydraulic Mfg. Co., 75 West St., New York City.

New Tractor Equipment

232 Literature describing Southwest tractor equipment, including cable-controlled carry-type scrapers, sheepsfoot tamping rollers, road rippers, bottomless scrapers and rotary self-cleaning rippers, may be secured by those interested direct from the Southwest Welding & Mfg. Co., Alhambra, Calif.

Front-End Loaders for Wheel Tractors

233 White front-end loaders, shovels and backfillers for mounting on wheeled industrial-type tractors, are made in several models and sizes, and are described and illustrated in a new Circular No. 30 which may be secured direct from the White Mfg. Co., Elkhart, Ind.

A Transparent Cure for Concrete

234 Ritecure, a colorless curing and waterproofing agent which is sprayed on green concrete to protect it against evaporation, forming an impervious film over the concrete, but leaving its natural color unchanged, is described in a folder which may be secured direct from the Johnson-March Corp., 52 Vanderbilt Ave., New York City.

Arc Welding as a Career

235 "Building a Career in Arc Welding" is the title of a new 8-page booklet recently published by the Lincoln Electric Co., Cleveland, Ohio, describing the practical and technical instruction available at the Lincoln Welding School for men interested in arc welding. Copies are yours for the asking by mentioning this magazine.

Hand Book on Care of Wire Rope

236 An interesting and useful 28-page booklet on the use and care of wire rope, including such information as how to reel and unreel wire rope, ways of seizing, splicing, proper working loads, proper sheave and drum sizes, lubrication and measuring, may be secured by interested contractors and engineers direct from the Wire Rope Corp. of America, New Haven, Conn., by mentioning this magazine.

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1/2 YARD Clipper

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METERED Vacuum CONTROL

No Operator Fatigue

Skill of the operator - not his endurance - hangs up records of big yardage moved with the Buckeye 1/2 Yard Clipper. Every movement of the Buckeye Clipper is controlled by finger-tip pressure on easy operating vacuum control levers. Swing, travel and hoist simultaneously if the job calls for it.

Ease of control is matched by dependable performance. The new METERED VACUUM CONTROL SYSTEM of the Buckeye Clipper is unaffected by changes in temperature, by small leaks, or water in the lines. Do not confuse this control system with hydraulic or air pressure systems. Write for complete information before you buy any 1/2 Yard excavator.

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The Littleford No. 101 Utility Sprayer has twin burners and U type heat flues. Sizes 300 to 1200 gallons for two or four wheeled trailer or truck mounting. Your choice of either 50 or 100 G. P. M. pump with air cooled driving engine. Ask for Bulletin K-5.

LITTLEFORD

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California Uses Diagonal Floats

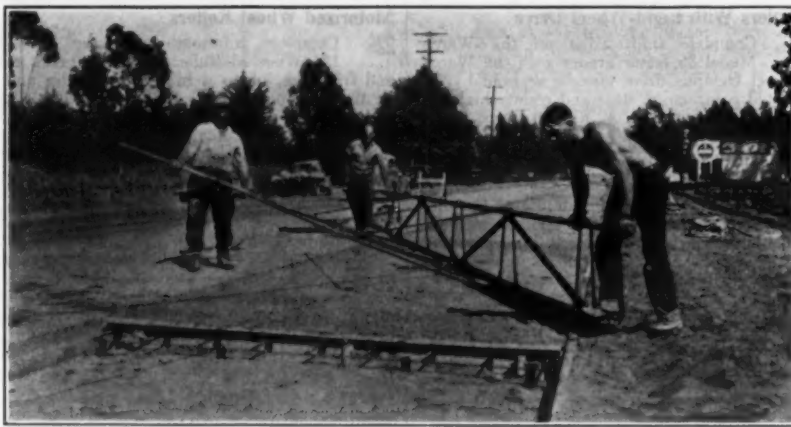
Unit 24 Feet Long Acts as Combined Screed and Float to Insure Smooth Surface

ONE and sometimes two diagonal floats of a type not used in other states are employed on portland cement concrete highway pavement construction in California to screed and float the surface and provide a smooth riding pavement. The first and heaviest, 440 pounds, is 24 feet long and is pulled along the strip of concrete by a horse with two or three men managing the angle of pull and keeping the two ends at the proper position on the forms or adjacent slab.

The screed proper is an 8.2-pound 6-inch channel with 1/8-inch plates welded on the legs to make them 4 inches high. It is supported and adjusted to a true plane by trusses made of 18-gage tubing, into the ends of which are welded 5/8-inch studs which in turn are connected by two opposing adjusting nuts to ears welded to the screed. Its general construction is shown in the illustration.

Manipulation

The horse pulls the screed or float by a 50-foot steel cable and makes five to seven traverses over the slab to be finished. The early trips cut the high spots from the concrete and the later runs smooth the material and fill the low spots, leaving a remarkably smooth surface. The forward end of the long screed is run on the side form and is weighted down by a man pressing on the end or even riding the end. The other end is permitted to run about 1 foot in from the other edge, leaving a windrow of concrete along the opposite side. The man at the back end of the tow float moves his end in and out so as to fill the edge and leave a windrow of concrete or mortar where it can be picked up when the forward end of the float is run on that side on a later trip. When only rocks are following along the screed, he pulls his end over the header and pushes the rock outside of the road forms. The windrow



C. & E. M. Photo

The Diagonal Float Finishing the End of a Day's Run

cut by the screed, which is operated at about 23 degrees, is shoved back onto the slab by reversing the side on which the forward end of the tow float slides.

Another important manipulation of the screed is by the man who holds the long handle. He governs the amount the tow float will cut by raising or lowering the handle which is rigidly fastened to the float screed. On the first trips, he takes a heavy cut so as to move any high places left by the mechanical finishing machine. On later trips, he cuts just enough to carry a roll of mortar the full length of the screed.

The concrete used is 1 to 2-inch slump and the repeated working of the surface by this screed brings a slight grout to the surface which aids the finishers. The operation was observed particularly on a 10-foot widening strip. On the final trips of the tow float, no use was made of the old concrete slab as a template because of the possibility of slightly rough spots or exuded joints being reflected in the new strip. The slab was 0.55 foot thick for the center 6 feet and thickened to 0.75 foot at the edge.

The Follow-Up Float

A second float of similar construction but with a Philippine mahogany 4-inch x 6-inch x 20-foot screed was used both as a towed float and as a longitudinal finishing float. When used as a longitudinal finishing float, two men operated it. The float man worked on the side with the handle and braces and governed the cutting operation. The second man worked on a push pole on

the opposite side of the slab. By pushing and pulling on an angle, he moved the float diagonally across the slab and thus moved the float along the center line of the work. This saves from 20 to 30 per cent of the finisher's time as he does not have to pick up his float to move it along the center line. The mahogany timber was used because it wears evenly, does not warp and is one of the few hard woods available in 20-foot lengths. A 16-foot bump cutter follows the other floats as the final operation, after the surface has taken a slight set. This is standard for all state work, even where the diagonal float is not used.

The sections generally used for pavements in California are flat for 10 feet, any crown being made by adjusting the header grades. The above methods of finishing would not be practical for curved cross sections.

The diagonal float was developed by G. H. Lamb, Jr., an inspector in District

VII of the California Division of Highways, Department of Public Works.

Contracts Awarded For New Steel Mill

The contracts for the excavation, grading and construction of foundations and sewers for the Irvin Works steel mill of the Carnegie-Illinois Steel Corp., of Chicago, have been awarded to A. Guthrie & Co., of St. Paul, Minn.; John Marsch, Inc., of Chicago; and Edward Peterson Co., of Omaha, Nebr.

Clearing and preparation of the site for the construction of this mill, which will have a capacity output of 600,000 tons of sheet, strip and tin plate, is expected to require about 12 months. Excavation of approximately 3,500,000 cubic yards of earth and about 150,000 cubic yards of foundation concrete are involved. Immediate work at the site includes clearing of approximately 200 acres of a 600-acre tract.

The contractors are to furnish all labor, tools and equipment for excavation, filling, grading and removal of material, and build sewers and concrete floors and foundations. In addition, the estimates include 7,000,000 pounds of reinforcing steel and 2,100,000 pounds of anchor bolt washers and manhole steps. The contract calls for 200,000 square yards of fine grading for floors and provides also for approximately 200,000 square yards of 6, 8 and 10-inch concrete floors. Hard finished surfaces for heavy traffic are estimated at 10,000 square feet.

The British Columbia Provincial Government is planning the expenditure of the \$3,000,000 loan recently procured in eastern Canada for the construction of roads.

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Equipment Distributors

The Directory of Equipment Distributors is continued on the pages following.

Alabama-California

<p>TURNER SUPPLY COMPANY N. W. Corner of St. Louis and Commerce Sts. MOBILE ALABAMA</p> <p>Representing</p> <p>McKERNAN-TERRY CORP.—Pile Hammers, Cranes, Shovels, Loaders</p> <p>INDEPENDENT PNEUMATIC TOOL CO.—“Thor” Air and Electric Tools</p> <p>WILLIAMS—Clamshell and Dragline Buckets</p> <p>AMERICAN STEEL & WIRE CO.—Monitor Wire Rope</p> <p>DOMESTIC—Pumps and Motors</p> <p>M & N Pump Company</p> <p>WYOMING—Red Edge Shovels, Scoops</p> <p>Representing</p> <p>LINK-BELT CO.—Crawler Cranes, Shovels, Loaders</p> <p>WESTERN WHEEL SCRAPER CO.—Wheel-Scraper, Drags, Scrapers, Fronts, Ploughs</p> <p>BATES—Bar Tie</p> <p>JAEGER—Concrete Mixers</p> <p>Paving Equip., Chuting Equip.</p> <p>BEERE BROS.—Hoists and Saws</p> <p>LE SOI COMPANY—Air Compressors, Gasoline Hoists</p>	<p>ARIZONA TRACTOR & EQUIP. CO. 1402 North 19th Ave., P. O. Box 1494, Phone 3-1146, Phoenix, Ariz.</p> <p>Representing</p> <p>CLETRAC Tractors</p> <p>ATECO Dirtmovers, Bulldozers, Tamping Rollers, Scarifiers</p> <p>BROOKVILLE Locomotives</p> <p>BROS. Bulldozers, Angle-Dozers, Snow Plows</p> <p>SUGVUS-ERIE Shovels</p> <p>BUFFALO-SPRINGFIELD Rollers</p> <p>CLEVELAND Rock Drills</p> <p>EAGLE Crushers</p> <p>GARWOOD (Isaacson) Bulldozers, Ac.</p> <p>KEWANEE Conveyors</p> <p>LITTLEFORD Asphalt Equipment</p> <p>SCHRAM Compressors</p> <p>SMITH Mixers</p> <p>WHITE & INDIANA Trucks</p> <p>Member: Associated Equipment Distributors</p>	<p>F. RONSTADT HARDWARE COMPANY “Pioneers in Good Merchandising”</p> <p>TUCSON ARIZONA</p> <p>BROOKVILLE Locomotives</p> <p>BAY CITY Shovels</p> <p>SALON Graders and Rollers</p> <p>McCORMICK-DEERING Industrial and Crawler Tractors</p> <p>McCORMICK-DEERING Diesel and Gas Power Units</p> <p>STERLING Portable Pumps</p> <p>POMONA Turbine Pumps</p> <p>MYERS Pumps</p> <p>KIMBALL-KROGH Centrifugal Pumps</p> <p>QUICKWAY Truck, Shovels and Cranes</p> <p>SMITH Crushers and Screening Plants</p> <p>TOLEDO Road Turches</p> <p>WOOD Hand Shovels</p>	<p>GARLINGHOUSE BROS. 2416 E. 16th St. Los Angeles, Calif.</p> <p>Southern California Distributors for</p> <p>RANSOME—Concrete Mixers, Pavers, Pans, Placers, Grouters, Concrete Paving Equipment</p> <p>WORTHINGTON—Portable Compressor, Pneumatic Tools, Jackhammers, Pumps, etc.</p> <p>BROWNING—Truck Cranes, Shovels, Locomotive Crane</p> <p>OWEN—Clamshell Buckets</p> <p>OMAHA—Dragline Buckets</p> <p>WHITCOMB—Gasoline, Diesel, Electric Locomotives</p> <p>A. LESCHEN & SONS—Wire Rope</p> <p>McKERNAN-TERRY CORP.—Pile Hammers</p> <p>LANBERT-NATIONAL—Hoists and Cableways</p> <p>DIAMOND IRON WORKS—Crushers, Portable Gravel M.</p> <p>RAMSEY—Hand and Power Winches</p> <p>NOVO—Engines, Pumps, etc.</p> <p>UNIVERSAL—Panel Forms, Form Clamps, etc.</p> <p>Manufacturers of Gar-lure Concrete Cars, Wheelbarrows, Concrete Hoppers, Buckets, etc.</p>
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BUCHSUS-ERIE Cranes, Shovels
BUTLER Bins, Batches
CARBIC Lights
CHICAGO PNEUMATIC Air Compressors
DOMESTIC Pumps, Hoists
GENERAL ELECTRIC Motors
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HYPERPRESSURE JENNY Vapor Cleaning Machine
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NOVO Engines, Pumps and Hoists
GALION Road Graders
CHAMPION Rock Crushers
ERIE Aggregators Plants
RANSOME Concrete Mixers
WORTHINGTON Air Compressors
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"CATERPILLAR" Tractors, Graders, Power Units, etc.
BLAW-KNOX—Bins and Batches.
BLAW-KNOX—Finishers, Ball Wagons, Forms, Bins, Buckets, Batches.
BARBER-GREENE Ditchers, Conveyors, Loaders.
CEDAR RAPIDS Crushers.
CONNEY Kettles, Tools.
CLYDE Hoist & Erect. Eq.
RAMSEY Winches & Hoists.
BUFFALO-SPRINGFIELD Rollers.
KILLEFER Rippers, Drag Scrapers, Pumps, Harrows.
LAPLANT-CHOATE Cranes, Dump Wagon, Bulldozers, Tampers.
WINDLOW Scales.
WARD Road Pumps.
RUSSELL Road Pumps.
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AMERICAN HOIST Cranes, Shovels, Draglines, Bulldozers, Snow Blowers.
BATES Wire Ties, etc.
BEER BROS. Hoists.
CHAIN BELT Mixers, Pavers, Pumps, Saw Rigs, Conveyors, Elevators, Pumpcrete, Moto Mixers.
ERIE Steel Bins, Batches, Acremeter Plants.
INLEY Concr. Towers, Chuting, Cranes, Shovels, Choker Hooks, Carts.
McKernan-Terry Corp. (Division)
McKERNAN-TERRY—Pile Hammer, Extractors
LAMBERT-NATIONAL—Hoists, Cableways
STEEL & CONDUIT—Special Machinery
Wheelbarrows, Hoist, Cable Rope, Tarpsaulins, etc., carried in stock
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BLAW-KNOX—Road Forms, Bins, Batches, Finishing Machines, Buckets.
GORMAN-RUPP—Self Priming Centrifugal Pumps, Road Pumps.
LITTLEFORD—Distributors, Tar Kettles, Heaters, Torches.
PARSONS—Trench Machines, Backfillers, Turbo Mixers.
C. H. & E.—Road Pumps, Saw Rigs, 2-Ton Rollers.
IOWA—Crusher Plants, Asphalt Plants.
R. B. Feyer Subgraders, Trailgraders.
WORTHINGTON—Compressors, Air Tools, Hose.
CLEVELAND—Subgraders, Straight Edges, Finishing Tools.
Concrete Carts, Wheelbarrows, Supplies

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400 Franklin Street Peoria, Illinois

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Allsteel Products Mfg. Co.
Athy Truss Wheel Co.
Caterpillar Tractor Co.
Gardner-Denver Co.
Frank G. Hough Co.
Killefer Mfg. Corp.
LaPlant-Choate Mfg. Co.
R. G. LeTourneau, Inc.
Speeder Machinery Corp.
Williams-Hyster Co.
Universal Crusher Company
Telephone 6177

INDIANA EQUIP. CO., INC.

327-329 West Market St., Indianapolis, Ind.

Representing
ATHEY TRUSS—Wagons, OWEN—Clam Shell Buckets.
BUFFALO-SPRINGFIELD PAGE—Dragline Buckets.
"CATERPILLAR"—Road SAUERMAN—Cableways, Machinery, Power Scrapers.
"CATERPILLAR"—Tractor UNIVERSAL—Crushers, Pulverizers.
GARDNER-DENVER—THEW—Shovels, Draglines.
Compressors, Tools TYLER—NIAGARA—Vibrating Screens.
LAPLANT-CHOATE—Wagons, Scrapers, Bulldozers.
LE TOURNEAU—Scrapers, Buggies, Bulldozers.
Member: Associated Equipment Distributors

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Representing
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CHAIN BELT—Mixers, Pavers, Pumps, Saw Rigs, Conveyors, Elevators.
CLYDE—Gasoline and Steam Hoists, Derricks.
HOUGH—Universal—Sweepers.
MASTER—Vibrators, Generators, Arc Welders.
SULLIVAN—Air Compressors, Tools.
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TIMKEN—Detachable Rock Bins, Steels.
UNIVERSAL—Truck Cranes.
UNIVERSAL—Form Cranes.
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C. H. & E. Road Pumps, PIONEER Crack and Joint Filler.
RUSSELL Scrapers, Drags, KENNEDY Crushers, Screws, Elevators.
KNICKERBOCKER Concrete Mixers, LANDI High Efficiency Air Compressors.
BAY CITY Shovels and Cranes, BARRET Asphalt Expansion Joint.
BETHLEHEM Reinforcing Bars, LeCROSSE Two-Way Machinery Trailers.
HERCULES Road Rollers.

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Paducah Kentucky

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Bates Bar Ties
Bates Tractors
Beebe Hand Hoists
Black & Decker Tools
Cedar Rapids Crushers
Chain Belt (Box) Mixers
D-A Lubricants
DuPont Explosives
Doble Derricks
Elastic Expansion Joint
Enslid Scrapers
Farquhar Engines, Boilers
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Gulf States Reinforcing
Hansen Excavators
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BYERS Cranes, Draglines.
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GALION Graders, Rollers.
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R. G. LE TOURNEAU, INC.
GARDNER-DENVER CO.
INVADEE SHOVELS
WILLAMETTE-HYSTER CO.
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E. D. ELYRE & CO.
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ROGERS BROS. CO.
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Worthington Pump & Machy. Corp.
Lin Mfg. Corp.
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LaBour Co., Inc.
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Iowa Mfg. Co.
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Reed-Prentiss Corp.
Truscon Steel Co.
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Lambert-National Hoists
Goodall Rubber Co.
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E. D. Elyre & Co.
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CENTAUR—Road Mowers.
ADAMS—Leaning-Wheel Graders.
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Debbis Fdry. & Mach. Co.
Duff-Norton Mfg. Co.
Galton Iron Wks. & Mfg. Co.
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Harrington Co.
Ingersoll-Rand Co.
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BLAW-KNOX—Steel Forms, Bins, Buckets, Finishers.
PIONEER—Crushers, Gravel Plants.
CARTER—"Humdinger" Pumps.
INGERSOLL-RAND—Air Compressors.
ORR-SEBOW—Hoists, Boilers, Mixers.
HAUCK—Oil Burners and Heaters.
HAISS—Elevators, Conveyors and Loaders.
ALLIS-CHALMERS—Tractors.
BAKER—Bulldozers.
BEER BROS.—Hoists.
CLEVELAND—Formgraders.
C. R. JAHN CO.—Trailers.
BURCH—Road Pumps, Road Machinery.
HONESTAD—Pressure Jump Cleaner.
C. H. & E.—Pumps, Saw Tables, Hoists.
PIERCE—Rollers.
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Four-Wheel Drive Sales Co.
Huber Mfg. Co.
Ingersoll-Rand Co.
Jager Machine Co.
Jones Superior Machine Co.
A. Leachon & Sons Rope Co.
Lima Locomotive Wks., Inc.
Shovel & Crane Division
Lima Manufacturing Corp.
McKernan-Terry Corp.
Lambert-Nat'l Hoist Div.
Owen Bucket Co.
Page Engineering Co.
Parsons Co.
Red Star Products Co.
Rogers Bros. Corp.
Saugen Derrick Co.
Sauerman Bros. Inc.
Syntron Co.
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Archer Iron Works
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Butler Bin Company
Domestic Engine & Pump Co.
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Independent Pneumatic Tool Co.
LeROI-Rix Compressors
Saugen Derrick Company
T. L. Smith Company
Smith Engineering Works
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KELLER TRACTOR & EQ. CO., Inc.

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Atco—Dirt-moving equipment and bulldozers.
Baker Mfg. Co.—Snow plows, road machinery.
Bres-Tank Car Heaters, Post Rollers.
Burgess-Erie Company—Shovels, cranes, draglines.
Caterpillar Tractor Co.—Tractors, graders, road machinery.
D-A Lubricants Co.—Lubricants.
Dittler Mfg. Co.—Hercules spreaders.
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Gardner-Denver Co.—Air compressors and tools.
Killefer Mfg. Corp.—Road and farm tools.
LaPlant-Choate Mfg. Co.—Bulldozers, backfillers, wagons, snow plows.
A. Leachon & Sons Rope Co.—Wire rope.
H. G. LeTourneau, Inc.—Dirt moving, road equipment.
Rotary-Snow Plows.
Sterling—Pumps, Hoists, Saw Rigs.
Timken—Rock bits.
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Member: Associated Equipment Distributors

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Lakewood Engineering Co.
Northwest Engineering Co.
Sullivan Machinery Co.
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Clyde Sales Company
Gallen Iron Works
Page Engineering Co.
American Steel & Wire Co.
Burch Corporation
Reas-Horn Pumps
Saugen Derrick Company
Sauerman Brothers
Syntron Company
LeROI Company
Aerol Burner Company
Conroy & Company
Jones-Superior Company
Hertz-Bennett Company
Ames Shovels
Rove Manufacturing Co.
Red Top Steel Post Company
Teledo Pressed Steel Co.
Bates Wire Ties
Electric Taper & Equip. Co.
Saugen Wheelbarrows
Trackson Co.

LANGE TRACTOR & EQ. CO.

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Caterpillar Road Machinery and Tractors
LaPlant-Choate Wagons, Bulldozers, Snow Plows, Scrapers
Killefer Scrapers, Road Discs, Rippers
Durey Air Compressors
Cleveland Rock Drills
Ames Baldwin Wyoming Hand Shovels
Hansen Trailers
Williams-Hyster Hoists and Winches
Wasson Tractor and Truck Snow Plows
Davenport Gas and Diesel Locomotives
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Anthony Power Loaders
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Speeder Shovels
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CHICAGO Pneumatic Compressors and Tools
MCGONICK-DEERING Industrial Tractors
KWIK-MIX Mixers
RIDDELL Power Grader
JOHNSON Batches and Demountable Bins
TRACKSON Loaders and Cranes
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VULCAN Steam and Gas Locomotives
SARGENT Snow Plows
METAL FORMS CORP. Steel Forms
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"CATERPILLAR"—Tractors, Engines, Road Machinery
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LETOURNEAU—Dirt Moving, Road Equipment
KILLEFER—Road Rippers, Scrapers
ATHEY—Crawlers, Dump Wagons, Trailers
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PIONEER—Crushers, Gravel Plants
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Blaw-Knox Bins, Forms, Buckets, Finishers
B-H Hand Hoists
Clyde Hoists, Derricks
Cleveland Formgraders
Continental Scrapers
Diamond Crushers, Screens
Gar Wood Hydraulic Scrapers
Hais Leaders
Hercules Road Rollers
Hough Universal Swooper
Hydraulic Pumps
Jackson Tampons
Koppel Industrial Cars
McKinnon-Terry Pile Drivers, Extractors
M-W Lubricants
Michigan Power Shovel
Northern Conveyors
Northwest Shovels, Cranes
New Pumps
Oshkosh 4-Wheel Dr. Trucks
"Pig" Power Subgraders
Smith Mixers, Pavers
Sullivan Compressors, Tools
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Thew Shovel Co.
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Butler Bldg. Co.
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Dempsie Bros.
C. R. Jahn Co.
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DETROIT HOIST & MACH. CO.—Air and Electric Hoists
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WM. H. KELLER, INC.—Super Pneumatic Tools
MUNSELL—Air-Operated Concrete Vibrators
PANGBORN CORP.—Radiant Equipment
PENNSYLVANIA—Air Compressors and Pumps
DAVID ROUNDELL—Chain Hoists
STAYNEW—Air and Pipe Line Filters
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VICTOR—Welding and Cutting Apparatus
WESTINGHOUSE—Arc Welding Equipment
GUSTAV WIEDEKE CO.—Tube Expanders

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Blaw-Knox Company
Buffalo-Springfield Roller Co.
Caterpillar Tractor Co.
Killefer Mfg. Co.
LaPlant-Choate Mfg. Co.
Pioneer Gravel Equip. Mfg. Co.
Thew Shovel Company
Willamette-Hyster Co.
R. G. LeTourneau, Inc.
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Member: Associated Equipment Distributors

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Wm. Bros. Roller & Equip. Co.
Gardner-Denver Co.
General Woodhewer Co.
Yale Pressed Steel Co.
Contractors Machinery Corp.
Diamond Iron Works, Inc.
Orr & Sombower, Inc.
Construction Machinery Co.
Fairbanks, Morse & Co.
Ames Baldwin Wyoming Shovel Co.
Aerofil Shovel Co.
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Klein-Logan Co.
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Cleaver-Brooks Co.
Huber Mfg. Co.
Insley Mfg. Co.
Koehring Co.
Kwik-Mix Mixer Co.
Lidgerwood Mfg. Co.
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Hauk—Heaters
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Skilaw—Electric Saws, Drills
Skilaw—Shovels
Lafayette—Engines
Syston—Column Clamps
Winlow—Weighing Scales
Universal—Form Clamps
Link-Belt—Cranes, Shovels, Draglines
New—Pumps
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Chicago Pneumatics Tool Co.
Cleaver-Brooks Co.
Clyde Sales Co.
Coffing Hoist Co.
Columbia Steel Casting Co.
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Eagle Corporation
Euclid Road Machy. Co.
Festa Company
Gallen Iron Wks. & Mfg. Co.
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Complete Line of Road Machinery
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KOEHRING Mixers, Pavers, Shovels
INSLEY Concr. Towers
PARSONS Ditchers
PANTHER Oil, Grease
Steel Bridges and Traffic Trends, Fresno, Plows, Scrapers, etc.
COLEMAN Trucks
OWEN Buckets
SCHRAMM Air Compressors
MacWHYTE Rope
CLEVELAND Rock Drills

HEYNIGER BROTHERS
Contractors' Equipment
6th Ave. and F St. Belmar, N. J.

JAEGER Concrete Mixers
JAEGER Placing Plants
AEROIL Torches, Heaters
Steel Sidewalk and Curb Forms
"Mud Hog" Pumps
Material Elevators
Air Compressors
Gasoline Hoists
Trench Pumps
Carbide Lights
Wheelbarrows
Mortar Tubs
Steel Mortar Boxes
Picks and Shovels
Tarpaulins
Scaffold Horses
Electric Drills & Saws
Chain Hoists

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113 Frelinghuysen Ave., Newark, N. J.

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P & H Cranes and Excavating Equipment
P & H Hansen Electric Arc Welders
INGERSOLL-RAND Compressors and Tools
STERLING Wheelbarrows
AEROIL Heaters and Tools
ALEMITE Guns and Fittings
REX Mixers and Pavers
REX Pumps
REX Saw Rigs
UNIVERSAL Concrete Accessories
VIBER Elec. & Pneu. Concrete Vibrators
WINSLOW Scales
WALSH Snow Plows
Member: Associated Equipment Distributors

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60 Marshall Street Newark, N. J.

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SCHRAMM Air Compressors, Tools
ALLIS-CHALMERS Tractors, Graders
JOHNSON Steel Bins and Batches
ERIE Gasoline Rollers
MARLOW Centrifugal, Diaphragm and Plunger Pumps
STYRE Tar and Asphalt Distributors
WILLIAMS Trailers and Buckets
RED STAR Wheelbarrows, Batch Bins, Column Clamps
and Adjustable Bins
OSGOOD Shovels, Cranes and Draglines
GENERAL Shovels, Cranes and Draglines
HOTCHKISS Road and Sidewalk Forms
VIBRO-CAST & JACKSON Concrete Vibrators and Elec. Power Plants
AMERICAN Snow Plows
HY-WAY Spreaders

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Jaeger Machine Co.
General Excavator Co.
Ingersoll-Rand Co.
Link-Belt Co.
Baker Mfg. Co., Inc.
Huber Mfg. Co.
Hough Universal Sweepers
Pioneer—Gravel Plants, Crushers

DOW & COMPANY, INC.
Court & Wilkeson Sts., Buffalo, N.Y.

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BARCO—Gasoline Hammers
C. H. & E.—Pumps, Hoists, Saw Rigs
CHICAGO PNEUMATIC TOOL CO.—Compressors, Drills
EUCALD—Earth-Moving Equipment
FRINK—Saw Pumps
HOUGH-UNIVERSAL—Sweepers
INTERNATIONAL—Tractors & Power Units
MOHAWK—"Hotstud" Kettles, Burners
T. L. SMITH—Mixers, Pavers, Tower Pavers
THEW-LORAIN—Shovels, Cranes
TONGAN—Corrugated Culverts
UNIVERSAL-LORAIN—Shovels, Truck Cranes
WALTER—Snowblasters, Tractor Trucks
"WILLIAMS"—Buckets, Trailers
"WILLIAMSPORT"—Wire Rope
Member: Associated Equipment Distributors

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3090 Main St. Buffalo, N. Y.

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Sale and Rent of All Kinds of Construction Equipment

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LACROSSE Trailers
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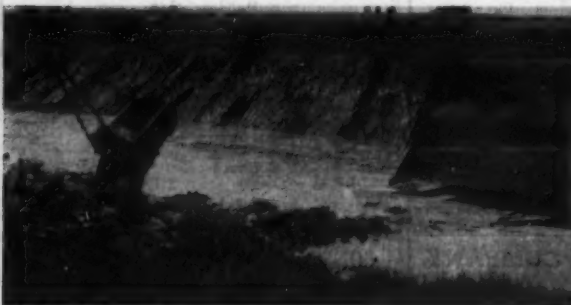
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The Varied Plantings on the Different Gradients in a Cut and a Paved Outlet, at the Right, at a Critical Point Between Cut and Fill, To Prevent Erosion on a TVA Road. See Page 28.



C. & E. M. Photos

Making Neat Slopes with a Special Slackline Rig and Dragline Bucket on a Flood Control Project. Left, Note the Well-Trimmed Slope, and Restricted Old Channel in Foreground. Center, Detail of the Dragline Bucket Rigging. Right, a Section on Which the Riprap Had Been Completed. See Page 1.



Left, On the East End of the Skousen Bros. Grading Contracts, Where the Rock Was Soft, a Seventy-Five Diesel With a Heavy Ripper Broke Up the Rock for the Carryalls and Bulldozed It on the Fill.

C. & E. M. Photo



C. & E. M. Photo

Right, On the West End, a Forty Tractor Bulldozed Shattered Ledge Rock to the Hopper of the Crushing and Screening Plant Which Furnished Aggregate for Concrete Structures. See Page 5.



Left, An A-C Patrol Grader Starting the Mixing Operation On Skin-Mat Maintenance of Gravel Roads with Top Soil and Asphaltic Oil on U. S. 53 North of LaCrosse, Wisconsin. See Page 1.

C. & E. M. Photo

Right, Applying the Cut-Back Asphalt for the 2-Inch Road-Mix Surface to Widen and Modernize a 4.3-Mile Section of Old Penetration Macadam Westchester County, N. Y., Road. See Page 8.



C. & E. M. Photos

Batch Trucks on Hurden Construction Co.'s Concrete Paving Contract Between Roanoke and Benson, Ill., Had Pairs of Wood or Galvanized Covers to Protect Aggregate and Cement During Hauling. Left, the Two-Batch Trucks Received the Bulk Cement at the Loading Platform from Kone-Karts Dumping Through Two Slots. See Page 2.



A Don K. Oliver Photo of Night Operations at O'Shaughnessy Dam, Part of Hetch Hetchy Water Supply for San Francisco. See Page 2.